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Pennsylvania State Horticultural Association News

PUBLISHED BY THE ASSOCIATION

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Vol. XIV

State College, Pa., March, 1937

No. 1

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1938 report -
out of print*

78



Proceedings of the
Seventy-eighth Annual Meeting

Farm Show Building, Harrisburg, Pa.

January 20 and 21, 1937

**SPRING TIME
AND
PLANTING TIME
ARE JUST ABOUT HERE**

THE WISE MAN

**Plans and Plants
For the Future**

WE SPECIALIZE IN

APPLE TREES and PEACH TREES

STRAWBERRY and RASPBERRY PLANTS

GRAPEVINES and ASPARAGUS PLANTS

We Offer one of the Most UP TO DATE and PRACTICAL LISTINGS OF NEW AND IMPROVED FRUITS AVAILABLE TO THE PLANTERS TODAY.

INCREASE YOUR PROFITS BY PLANTING ONLY THE BEST.

OUR PRODUCTS ARE GROWN SCIENTIFICALLY AT A LOCATION GENERALLY RECOGNIZED AS A FAVORED SPOT FOR THE PRODUCTION OF HARDY AND THRIFTY NURSERY STOCK. OUR FRUIT TREES ARE INSPECTED YEARLY FOR TRUENESS TO NAME BY THE GREATEST AUTHORITIES IN THE WORLD ON THE IDENTIFICATION OF VARIETIES BY LEAF AND GROWTH CHARACTERISTICS. OUR STOCK IS DUG WITH THE MOST MODERN DIGGING EQUIPMENT AVAILABLE.

"OUR SERVICE AND STOCK WILL PLEASE YOU"

ONE OF THE EASTS LARGEST NURSERIES, SELLING DIRECT TO THE PLANTERS, AWAITS THE OPPORTUNITY TO SERVE YOU. SEND FOR OUR COMPLETE CATALOGUE TODAY-

Bountiful Ridge Nurseries

PRINCESS ANNE :: :: MARYLAND

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Held in Harrisburg, Pa., January 20-21*

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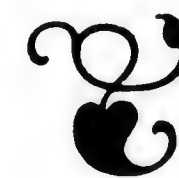
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Seventy-eighth Annual Meeting

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State Horticultural Association of Pennsylvania

OFFICERS FOR 1937

President	R. J. Gillan, St. Thomas
Vice President	J. A. Runk, Huntingdon
Secretary	J. U. Ruef, State College
Treasurer	C. B. Snyder, Ephrata

Executive Committee: The above named officers and C. J. Tyson, Gardners; H. M. Anderson, New Park; J. Eric Linde, Orefield; H. F. Hershey, Hamburg.

STANDING COMMITTEES

Legislation and Representatives on Agricultural Council: C. J. Tyson, Ch.; H. S. Nolt, Columbia; R. T. Criswell, Chambersburg, (Representative on Tax Committee).

State Farm Show and Exhibition: John Ruef, State College, Ch.; Paul Thayer, Carlisle; R. C. McDonald, Shippensburg.

Insect Pests: H. N. Worthley, State College, Ch.; H. E. Hodgkiss, State College.

Plant Diseases: H. W. Thurston, State College, Ch.; R. S. Kirby, State College; K. W. Lauer, Harrisburg.

Game Laws: J. A. Runk, Huntingdon, Ch.; Geo. Balthaser, Wernersville; R. H. Bell, Harrisburg.

True-to-Name-Trees: F. N. Fagan, State College, Ch.; G. L. Baugher, Aspers.

Inspection Fund: R. R. Wilkinson, Bureau of Markets, Harrisburg, Ch.; M. E. Knouse, Peach Glen; C. J. Tyson, Gardners; Norman Davidson, Chambersburg; H. F. Hershey, Hamburg.

SECRETARY'S REPORT

R. H. SUDDS, State College

With this meeting I terminate my seven-year term of service to the Association as Secretary, because of acceptance of a position in West Virginia. Only one other man has served you longer in this capacity; he was the late Enos B. Engle who was secretary for a total of thirty-two years.

I have been secretary through one of the most trying times in the 78 years history of this association. The depression was already on in full swing in 1930 when I was elected; now, when I am asking to be relieved of the duties of this office, recovery has come out completely from around the corner where it was in hiding for so long.

I point with great pride to the progress we have made during the past seven years. The membership has been increased moderately and the association is a more compact and unified group than when I first took over. Our News Letters other than the Proceedings have been increased in size and value and our advertising has become an important feature of our revenues. Now our Proceedings are sent all over the world.

The correspondence connected with the secretary's office has increased many fold so that the number now exceeds a thousand a year. The value of this society to all of you has been increased greatly and it will continue.

The progress made by the Association is not a result of the work of only one man. I have been fortunate in having as presidents a distinguished succession of men: I refer to Dr. J. S. Rittenhouse, Lorane; Mr. R. T. Criswell, Chambersburg; Mr. F. C. Reiter, Mars; and Mr. H. F. Hershey, Hamburg. You are indeed fortunate to have had such gentlemen to preside over your deliberations. May your selections continue to be as wise!

I must not neglect to mention Mr. C. B. Snyder, Ephrata, our treasurer, who has held that position for nine years. It is with regret that I sever official connections with Mr. Snyder as one of the fellow officers of the society. Don M. James, Bureau of Markets, has been of great service to us at each winter meeting.

Many others of you have been of considerable assistance to the welfare of this group as a whole and if I have not referred to you by name, it is not because I have failed to appreciate your efforts.

Now for a more personal note: I am leaving Pennsylvania simply because I have been offered a much superior position in West Virginia. I see there an opportunity to be of greater service to the industry. Although in another state, I shall often be closer to you in southern Pennsylvania than when at State College, for I shall have the horticultural work at the Kearneysville station as a part of my responsibilities. I hope that when we meet elsewhere you will not fail to make yourself known, for I may not recognize all of you immediately.

To proceed with Association affairs, at this time I regret to report the passing last September of Mr. H. E. Rozelle, Pittston. He was a familiar figure for many years at our meetings.

No banquet was scheduled this year because of the lack of a suitable place in which to hold it. The banquet last year in which we lost 54 dollars showed that it is indeed hazardous to guarantee any large attendance during the weather conditions liable to prevail during Farm Show week. Although you decided to continue meeting with and during the Show, I predict you will come eventually to considering some substitute, unless conditions at Harrisburg, both in the city and in the Show Building, improve greatly.

Our Summer Meeting, held at State College, on the last Monday and Tuesday of July, was quite a success. I would remind you that no motion was made relative to the place and time of the 1937 Summer Meeting.

The 1936 Summer Tour, through New Jersey, was a great success although very poorly attended. I shall be glad to have the Association's 1937 Summer Tour visit West Virginia, if it be the judgment of your affairs that there is the place to go. Should you decide to come, I shall be pleased to plan and escort your group during your stay in West Virginia. County tours will also be welcome.

Certain nurserymen are still showing a tendency to rename varieties already properly named. Along this line, I shall have for your later consideration, a resolution which is now being promoted at the January meetings of the Massachusetts Fruit Growers' Association. The improper renaming of varieties is at least a source of confusion and as it is usually practiced is downright dishonesty.

Mr. J. T. Bregger, Waynesboro, Associate Secretary of the American Pomological Society and Chairman of the Summer Tour Committee of that body, requests me to announce that the American Pomological Society is planning for this year a three-week tour to the West Coast. This tour will be made in special Pullman cars and probably will cover the Grand Valley, Colorado; one or two California fruit districts; Rogue River and Hood River Valleys of Oregon; Yakima or Wenatchee Valleys of Washington, and perhaps the Bitter Root Valley of Montana. The probable date will be the last half of June and the first week in July. If you are interested, please see Mr. Bregger.

I would call your attention to discussions of two growers' organizations engaged in promoting the apple publicity welfare of fruit growers in Pennsylvania. J. Eric Linde, Orefield, will speak on the Berks-Lehigh Mountain Fruit Growers Association, while Sheldon W. Funk, Boyertown, will explain the organization, aims, and operation of Appalachian Apples, Inc.

The S. W. Fletcher prizes for essays on horticulture written by vocational high school students will be awarded by Dr. Fletcher in person. We hope this annual award will stimulate interest in fruit growing among the younger people.

The arrangements with the American Fruit Grower will likely be continued. That magazine has held up in quality thus far and is the only real fruit growing publication in the East. Interesting little items from you are always appreciated by the editors.

TREASURER'S REPORT, 1936

C. B. SNYDER, Ephrata

Receipts to January 19, 1937.....	\$1,295.38
Expenditures.....	1,039.44
Cash on hand.....	255.94
Savings Account, Ephrata National Bank.....	622.96
University Ave., N. Y. City Apartment Bonds.....	200.00
	\$1,078.90

We have audited the accounts of the State Horticultural Association of Pennsylvania as submitted by the treasurer, Mr. Snyder, and found them to be correct.

(Signed) Auditing Committee.
GEO. ROHRER
FRANCIS G. REITER.

REPORTS OF COMMITTEES

Resolutions Committee

The following resolutions were submitted for the decision of the association and acted upon as indicated:

WHEREAS it appears that certain nurseries have revived the practice of renaming varieties; and whereas this practice can only result in confusion and ultimately in injury to the nursery concerned, be it resolved that the State Horticultural Association of Pennsylvania assembled in convention at Harrisburg, Pennsylvania, condemn this practice and be it further resolved that the secretary be instructed to send a copy of this resolution to any nurseryman guilty of the practice of renaming varieties. (Approved)

WHEREAS: We realize the value of meeting with fellow fruit-growers from our neighboring states of Virginia, West Virginia, and Maryland and have enjoyed and profited by the exchange of ideas with them individually, and

WHEREAS: We believe our problems and interests are so closely allied as to be practically common problems and interests, and

WHEREAS: We believe that a close association between the fruit-growers of our four States would be of inestimable value in our efforts successfully to meet the problems which will confront us, now, therefore,

BE IT RESOLVED: That our officers should confer with the officers of the Horticultural Societies in the other three states to see what can be done to bring about the closest possible cooperation between the four Societies, and be it further

RESOLVED: That our officers suggest the advisability

First, of Joint Annual Meetings.

Second, of a joint publication of outstanding merit and value.

Third, The formation of a Four-State Association of Fruit-Growers, to be organized and operated along efficient lines for the material advantages to be mutually gained.

(Approved)

BECAUSE the agricultural interests of Pennsylvania cannot progress and prosper without safe, adequate highways, and

BECAUSE the farmer and his truck constitute an important part of the highway transportation industry of the state and contribute a large share of license fees and gasoline taxes, and

BECAUSE there is an ever present tendency to use the funds built up from these fees and taxes for expenses that bring no benefit at all to the highways,

THEREFORE, we, the members of the State Horticultural Association of Pennsylvania hereby resolve that the only method of genuinely protecting highway funds for our own use is through an Amendment to the Constitution preventing any diversion of these funds.

We also hereby request that such an Amendment be enacted by the Legislature as soon as they can do so.
(Approved)

WHEREAS the 1935 session of the General Assembly, in Act No. 423, appropriated \$600,000 (later reduced to \$25,000) for the purpose of studying the effects of vitamin concentrates on undernourished school children of Pennsylvania,

WHEREAS Pennsylvania abounds in milk, fruits, and vegetables, and,

WHEREAS it will benefit not only the producers and dealers in such products but also the children to use natural foods,

NOW THEREFORE be it resolved by the members of the State Horticultural Association of Pennsylvania, that any further appropriations for the purpose of securing vitamins or minerals as an aid to correcting malnutrition in children include also the purchase of milk, fruits, vegetables, and other foods containing vitamins or minerals in their natural form.
(Approved)

WHEREAS, Don M. James, Bureau of Markets, has again been of great value to the Association for his services in connection with our annual meetings,

THEREFORE, be it resolved by the members of the State Horticultural Association of Pennsylvania, that we thank him once more for his work and that we send Secretary French a copy of this resolution.
(Approved)

WHEREAS, Dr. Richard H. Suds, for a period of seven years has served the association efficiently as secretary,

BE IT RESOLVED that this association express sincere appreciation of his efforts and extend to him best wishes for success in his new field of endeavor at West Virginia University.
(Approved)

WHEREAS, the intolerable conditions in the assigned meeting room, made it impossible to conduct our program in a satisfactory manner, and,

WHEREAS, the conditions are becoming worse each year,



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Arsenate of Lead

*..... A High Deposit Lead
Compatible with Summer Oils*

Containing as high percentage of killing ingredients as is possible to incorporate in an approved commercial arsenate of lead, GRASSELLI assured you of a high percentage control of codling moth. When used with summer oils this product acts as both an insecticide and an ovicide.

In addition, it goes into easy suspension in the spray rig and works well through long lines, thus eliminating costly delays due to sludge, clogged screens and nozzles and blocked lines. See your Grasselli dealer.

NUREXFORM ARSENATE OF LEAD

NUREXFORM is unusually effective in controlling codling moth and many other chewing insects. It is the ideal Arsenate of Lead for combining with Lime Sulphur, the natural reaction being reduced to a minimum.

NUREXFORM remains in suspension. No settlings in the tank of your sprayer—no sediment to be scraped off the bottom and thrown away.

E. I. DU PONT DE NEMOURS & COMPANY, INC.
GRASSELLI CHEMICALS DEPARTMENT



Wilmington, Delaware



THEREFORE be it resolved that the State Horticultural Association of Pennsylvania transfer the place of its annual winter meeting to Hershey or another satisfactory place.
(Rejected)

Resolutions Committee,
H. W. SKINNER, Chairman.

Legislative Committee

(Including Representation on State Agricultural Council)

The State Council has undergone some changes in organization and owing to an error in the records, this association has not been notified of recent meetings. Many matters of importance to Agriculture have been fostered and worked out by the Council over the years since its organization, among such matters being: Rural taxation studies and the endorsement of tax reform measures; extension of rural electrification advantageously to our farm people; the support of State College in the Legislature, especially in regard to agricultural research and extension. It was moved, seconded and carried, to continue the representation of the State Horticultural Association in the State Council of Agricultural Organizations.

The following matters of legislative importance have been referred to your committee.

The following resolution was presented by the Legislative Committee to the members of the State Horticultural Association of Pennsylvania at Harrisburg on January 21, 1937, for approval or rejection. The resolution was approved.

"Whereas, fruit growers and farmers of nearby states are exempted from state tax on gasoline, kerosene and fuel oil used exclusively on the farm, and whereas, the payment of such tax adds greatly to the cost of producing crops, placing our growers under a serious handicap in competing with farmers in adjoining states,

"Be It Resolved: that the State Horticultural Association of Pennsylvania through its officers and members, exert every effort in favor of legislation which will exempt farmers from the effect of state taxes on gasoline, kerosene and fuel oil when used exclusively for farm purposes."

A proposed bill to require marking of all fruit with a specified grade, whether in open or closed packages, when sold, exposed for sale, or transported within the state was explained and discussed. It was voted to disapprove this bill on the grounds that it would affect too many growers adversely.

The action of the State Highways Patrol in arresting drivers of farm trucks when on the public roads without inspection stickers and license plates was informally discussed. Since the meeting this matter has been followed up and two bills before the Legislature, exempting "Motor vehicles, trailers and semi-trailers," also "tractors and trailers" are being pushed.

The following communication offered by the Legislative Committee was signed by the officers of the Association and forwarded to the Secretary of Agriculture.

February 6, 1937.

To Hon. J. Hansel French, Chairman
State Farm Products Show Commission
Harrisburg, Penna.

Dear Mr. French:

At the seventy-eighth Annual Meeting of the State Horticultural Association of Pennsylvania, expression was given to some important matters which are transmitted herewith.

1. You are to be commended for many improvements in the set-up and conduct of the 1937 Show. Among these are better ventilation, some progress in dust control, elimination of many clap-trap exhibitors and especially the changes in Fruit Show staging.

2. You are following a wise course in keeping education as the foundation of the Show. It is the one point on which our Show stands out above all others. To this end you need the stalwart support of the thirty or more associations meeting in Harrisburg during Show week.

3. Unfortunately, when the Farm Show building was built, ardor for a great show clouded the judgment of the builders and the plans overlooked adequate convention and committee rooms. Our association met again this year under crowded and most uncomfortable conditions. This was especially true Wednesday afternoon when the speakers on our program literally **competed** with those of the Holstein Breeders, to make themselves heard.

4. Our association is mindful of the serious difficulties under which the Show Management has operated in assigning meeting rooms. In a desire to reduce this strain as well as to meet our own needs, we most urgently recommend that foremost in your plans for new building, you keep the importance of holding the many agricultural organizations together in a strong group. To this end we recommend that the plans include at least four major convention rooms and a considerable number, suitable for smaller groups and committees. We further recommend that a study be made of the membership rolls past and present, of the various associations, together with their growth prospects.

These suggestions are offered in the best of spirit and with a sincere desire to cooperate.

Respectfully submitted,
STATE HORTICULTURAL ASSOCIATION
OF PENNSYLVANIA

R. J. GILLAN, President

J. U. RUEF, Secretary.

Respectfully submitted,

C. J. TYSON, Chairman.

Game Committee

The Game Committee has done little work during the past year except to check on the new legislation proposed by the Game Commission and to safeguard the laws now on the statutes to protect the fruit growers' and farmers' interests. It has registered an objection to the proposed

dual system of granting small and large game licenses and to a too long closed season on female deer.

The Committee desires to caution all fruit growers who are subject to deer damage to ask for and insist on the special open season on female deer whenever they feel that such a season is needed and is advisable for their respective communities. These special open seasons have been the best protection we have secured thus far plus, of course, the provision for fencing special areas which is available to only a special few and expensive to all.

The Committee desires also to call to the attention of all Pennsylvania fruit growers that the Honorable Seth Gordon is again the Executive Secretary of the Pennsylvania Game Commission and that we can be assured of a sympathetic and understanding hearing when we carry our problems to the Game Commission.

Com. J. A. RUNK, Chairman,
R. H. BELL,
GEORGE BALTHASER.

State Show and Exhibit Committee

The fruit exhibit at the 1937 Farm Products Show was the largest display of fruit in the present building. There were 869 entries made by 127 growers from 17 counties. The "Gabriel Heister Award" was won by the Franklin County Horticultural Association.

The "Pennsylvania State Horticultural Association Cup" was won by Guy L. Hayman, Northbrook, Chester County, as a reward for showing the best bushel of apples in the show. The award was won with a bushel of Staymans. The 1937 award makes the third time Mr. Hayman has had the distinction of showing the best bushel and along with the third win goes permanent possession of the cup. Congratulations!

The alterations in the display resulted in many favorable comments, but the committee is open to suggestions that would make for a more attractive show in the future. It also wishes to extend its appreciation to the exhibitors who make the show possible and the members of the fruit committee who set up the show.

J. U. RUEF, Chairman.

True-to-Name Trees Committee

Prof. Fagan, Chairman of this committee, has written me asking that I report no activity of this committee during the past Summer, but plans are now being made for a variety School to be held in the Summer 1937.

An extensive study on the identification of stone fruits is being planned. This study will possibly be held under the direction of Prof. Upshall at the Vineland Experiment Station.

GEORGE L. BAUGHER,

Nominating Committee

For President: T. J. Gillan
For Vice President: J. A. Runk
For Secretary: J. U. Ruef
For Treasurer: C. B. Snyder

For Executive Committee: The officers of the organization, and C. J. Tyson, H. M. Anderson, J. Eric Linde, and H. F. Hershey.

It was moved and seconded that the nominations be closed, and the secretary was instructed to cast a ballot for the names proposed.

WM. SCHIEFERSTEIN,
W. E. GROVE,
FRED DICKENSHIED.

WINTER INJURY IN PENNSYLVANIA ORCHARDS IN 1935-36

R. D. ANTHONY, State College

The losses in Pennsylvania orchards from low temperature injuries during the last 20 years have been serious enough to make it highly desirable for us to study the conditions accompanying these injuries to find if there are control measures which we make take to prevent or decrease the losses. Any study of low temperature injury is complicated by the fact that it would be difficult if not impossible to find any two years when the casual conditions and the types of losses have been the same. Some years spring frosts are responsible for the injury; other years the intensity of the cold; and still other years the condition of the tree at the time of the injury was the casual factor.

Early in the spring of 1936 it became apparent that there had been serious injury to fruit trees during the past winter throughout considerable areas of Pennsylvania. To find the extent of this injury and to study the causes in order to find possible methods of preventing the recurrence of similar injuries, the fruit division of the Horticultural Department at State College spent much of the summer of 1936 making a survey throughout most of Pennsylvania and in some of the adjoining states.

Weather Conditions

A careful study was made of the weather records in the area covered by the survey*. The period from October 5 to 9, was unusually cold throughout Pennsylvania. At State College, the official minimum temperatures on October 7, 8, and 9 were 25 degrees, 27 degrees, and 29 degrees F, with corresponding temperatures at the college orchard of 19 degrees, 22 degrees, and 22 degrees F. Apples hanging on the trees were frozen to the core each morning. In the fruit regions to the east and south, temperatures were not so low as in the College orchard but were well below the frost point.

Immediately following this cold period, apple leaves showed very few external signs of frost injury but a few days after there was an unusually heavy drop of apple leaves throughout the state. Those leaves

*Most of the weather studies were made by William S. Clarke, Jr.

which did not drop at this time held on much later than usual. Apparently the normal formation of the abscission layer was upset by the freeze. In the late fall there was less than the normal amount of sunshine. The immediate effect of the cold period on the apple fruit was to cause the stem to separate from the spur much more readily and in ten days to two weeks there was a very heavy drop throughout the state. The frosted fruit softened rapidly; fruit picked even before the heavy drop had to be disposed of before Christmas.

January, 1936, will long be remembered by Pennsylvanians. The first half of the month was mild, with little snow cover in the eastern half of the state. On the nineteenth there was a sudden temperature drop accompanied by a blizzard. The weather moderated rapidly on the twentieth and twenty-first. The morning of January 22 was warm and bright and pruning crews in the western part of the state were working in their shirt sleeves at ten o'clock; by five o'clock a blizzard was rapidly blocking all roads and the thermometer had dropped to 10 or 15 degrees below zero,—a total drop of from 40 to more than 50 degrees. This sudden drop in temperature with snow and high winds was general throughout the state; but as the storm moved from southwest to northeast, the drop in temperature was progressively later in the day from west to east. At State College the temperature drop began early in the afternoon and did not reach its lowest point until late in the evening. In the main fruit regions of the state, south and east of the Alleghenies, it was a late afternoon and evening storm. Because of this change in the time of onset, the degree and intensity of the drop decreased to the east of the higher areas of the Allegheny Plateau. Total temperature drops in parts of southeastern Pennsylvania were as little as 30 degrees. There was also a lessening of the intensity of the cold beginning about halfway between Pittsburgh and Lake Erie and extending northward.

After this sudden drop the weather continued abnormally cold until nearly the end of February. At State College there were 13 days of sub-zero weather up to the 20th of February, when it was 8 degrees below zero. The blizzard of January 19 gave 15 inches of snow at State College and a heavier cover to the east. The snow cover was about two feet deep until March.

The Survey

Peach injury was so general and so severe throughout the state that this fruit was not a good guide to use in determining causes so most of the survey was confined to apples. Although peach injury was general the southern and southeastern regions of the state had a crop at least two-thirds of normal. Some branches and many buds were killed or injured but enough fruit buds escaped for a crop. In many peach orchards fruit buds proved more hardy than foliage buds and in some places peaches escaped with little injury while nearby apples were considerably injured.

The sweet cherries along the roadsides were found to be a valuable guide in each new region. Where these trees—chiefly Mazzard seedlings—showed any considerable amount of branch killing, some apple

tree injury of a less severe degree would be found. When any of the Mazzards were killed, some apple trees would be found with severe trunk or branch injuries.

Considerable care had to be used in interpreting fruit tree injuries, particularly with sweet cherries. Unusually low temperatures in both the winters of 1933-34 and 1934-35 had injured many fruit trees in all fruit regions of the state. Much of this injury consisted of dead areas of trunk cambium covered by unbroken bark. Few growers saw these until this dead bark began to come off in 1936; then they attributed the injury to the winter of 1935-36. In Baldwin and similar varieties where winter injury causes the death of the sapwood of lower branches, again much of the early injury escaped notice until considerably later.

It is highly probable that the full extent of injury from these past three winters has not yet become apparent. In the orchards at State College, no injury from the winter of 1935-36 was observed while this survey was in progress and it was almost by chance that dead areas of trunk bark were discovered in late September. Then a thorough examination showed a large proportion of the trees with injuries ranging from a few spots the size of a silver dollar to areas covering a third of the circumference of the trunk; some crotch injury was found also. Throughout the survey it was necessary to tap the trunks lightly with a knife handle to detect injury on many of the trees, although after a very hot period in July a large number of injured trees could be located by a yellowing of the foliage.

Area of Severest Injury

It was soon evident that, for the purpose of this survey, the state could be divided into three areas: a region in which there had been no damage from the winter of 1935-36; a region of severe injury where some entire orchards had been killed and where many orchards had as high as 50 per cent of the trees injured; and a transition, or marginal, zone where occasional orchards suffered some injury but where the total damage was not excessive.

The greatest injury to orchards was in the western half of the state in an elliptical area centering roughly around Pittsburgh and extending approximately 50 miles north and 25 miles south of that city, and 75 miles east with a somewhat indefinite western border in Ohio. The Pittsburgh area likewise presented the greatest contrasts. It was not uncommon to find in one orchard nearly all of the apple trees, regardless of variety, showing considerable damage, while in another orchard, only a few miles from the first, apple trees were without any visible signs of injury.

The initial factor predisposing the trees to injury in the Pittsburgh district were the heavy freezes of October 7, 8, and 9. Orchards in which these occurred were peculiarly liable to show severe damage and orchards on favorable sites where these freezes were not so severe exhibited little or no harm.

Soil freezing in 1935-36 was not a factor in this area, since the ground was heavily blanketed with snow.

The type of injury exhibited by apple varieties other than Baldwin, Rhode Island Greening, and Wagener, consisted of a complete or partial loosening of the entire bark cylinder of the trunk from a point near the ground line to or even including the bases of the scaffold limbs. McIntosh, which is usually considered a hardy variety, frequently showed this type of injury. In many instances, the bark cylinder split wide open by spring so that the grower was able early to see some of the injury. In other cases, while the bark was killed and loosened partially, it did not crack open in the spring and, to all appearances at that time, nothing seemed to be wrong with the tree.

Baldwin was the variety most often injured, as in 1933-34, even in orchards where no other varieties were affected. When individual trees had not borne a crop in 1935, the degree of injury was either reduced or apparently eliminated. Wagener and Rhode Island Greening also were injured severely. Trees of these three varieties showed limb and top killing, not the loose trunk bark type found in the other varieties.

Next to Baldwin, the chief sufferers were Stayman Winesap, Red Delicious, Rome, and McIntosh. Wealthy was not particularly resistant to bark loosening.

From the survey in the Pittsburgh area, it became apparent that old standards of hardiness to freezing were of little value when the killing was chargeable to a lack of maturity, instead of to the minimum temperatures attained. There were no hardy apple varieties when conditions of 1935-36 entered into the picture in this area of excessive killing.

Apple trees injured at the collar or higher up on the trunk in 1933-34, and which showed in consequence areas of dead bark, were apparently immune to damage in 1935-36.

Apple bud injury was fairly conspicuous in this area, although several orchards losing the greatest proportion of their trees because of loose trunk bark had what the orchardists claimed was a nearly normal bloom and crop. Abnormal apple blossoms also were observed by many growers.

Apple trees of both extremes of vigor were harmed, while those more nearly midway within these limits were considerably more resistant, all other factors being equal. It was evident that wet feet, previous drouth damage, a thin soil, severe spray injury, defoliation by scab, unchecked San Jose scale attacks, and the like had all played their part in increasing the amount of injury to trees of low vigor.

One large orchard injured most seriously was on a thin, fairly light soil of low fertility on which the trees had not recovered fully from the droughts of 1929 and 1930. In this instance, fertilizer applications were rather light, spray injury in 1935 was severe, the 1935 drop was heavy, and abundant autumn rainfall followed by the October freezes prevented the attainment of a proper degree of tree maturity. This orchard of about 100 acres was completely wiped out and the trees have been removed.

On the other hand, heavy applications of animal manures or commercial fertilizers likewise resulted in severe losses, especially if accompanied by late cultivation. One orchardist applied in April, 1935, 22

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pounds of ammonium sulfate per tree, disced the sod before bloom, then followed this with two pounds more sulfate per tree late in June. This liberality cost the owner a third of his fine, 22-year-old apple trees, chiefly Stayman Winesap. Another grower applied in the spring 8 pounds of sulfate of ammonia per tree, then cultivated frequently until late August, in the meantime fertilizing his trees very heavily with the manure from his large dairy herd. These practices have cost him dearly, for in addition to winter injury, fire blight in the summer of 1936 was raging on what vigorous trees were left relatively uninjured by freezing.

An attempt was made to correlate the usual commercial forms of nitrogen-carrying fertilizers with the degree of injury but no conclusion could be drawn from the evidence. Most of the growers in the Pittsburgh area had used calcium cyanamid in 1935, chiefly because of its considerably lower price per unit of nitrogen at that time as compared with other forms of nitrogen. When comparisons could be made with other forms of nitrogen, there was no evidence that cyanamid had either increased or decreased the degree of injury.

Most growers with severe tree injury had observed a heavy premature drop of leaves in 1935 following the October freezes, although some with considerable losses stated that the leaves had persisted abnormally late—until January and February.

Trees picked previous to the freezes tended to show less injury, although the distinction was not always clean cut.

There was some indication in this area that late autumn pruning had been a factor in promoting trouble, although too few growers had been able to do any pruning before the severe January weather to make this observation as well substantiated as might be desired.

Intermediate stocks utilized in several orchards with double-worked trees were a source of weakness. Spy was a failure as an intermediate stock for York and Stayman Winesap in the 28-year-old orchard of The Pennsylvania State College. Likewise, intermediate stocks of Winesap at an elevation of 2300 feet cost the owner all of his fine mature trees of Stayman Winesap. An intermediate stock of an unknown variety was responsible for injury to Northern Spy, McIntosh, and Stayman Winesap trees when trees of these varieties of a similar age, but not double-worked, showed little injury. In all three instances, the loose trunk bark did not extend above the upper graft union into the top variety.

Cherry trees, sweet and sour, but chiefly the former, suffered severely, especially when heavy 1935 crops were followed by premature defoliation by leaf spot. At one side of a young apple orchard just coming into bearing in which the loss of Wealthy and McIntosh trees was complete because of a loss of all trunk bark, half a dozen large sweet cherry trees were unharmed in wood, although all blossom buds had been killed. These sweet cherries had received two sprays after picking in 1935 which prevented leaf spot and held the leaves until they were frosted off. Just across the road from these cherries, every Baldwin tree in a four-year-old planting was completely dead.

Practically all bearing peach trees in commercial orchards in the Pittsburgh area were either killed outright or so severely injured that

their recovery was questionable. Non-bearing peaches showed much less injury, although twig killing or even a dying back of the tops to the snow line were common.

Marginal Zone of Fruit Tree Killing

The amount of injury in the Pittsburgh area was so great it was difficult to determine casual conditions. For this reason considerable time was spent in outlining and studying those marginal areas where slight environmental differences might be the cause of considerable difference in injury.

Injury from cold in the winter of 1935-36 was almost negligible in Western New York. The freeze in October had been nearly as severe there as in Pennsylvania. About a third of the leaves and much of the fruit dropped soon afterwards. The remainder of the leaves stayed on longer than usual. The temperature drop in January was not as extreme nor as rapid as it was further south. It is probable that this is the major factor responsible for the freedom from winter injury in this area.

Nearly all of the two northern tiers of counties in Pennsylvania lie in a region in which there was little or no injury of fruit trees. Fruit trees were unharmed at elevations of 1200 to 1400 feet when large numbers of *Prunus Pennsylvanica* were killed at elevations of 1700 to 1900 feet on nearby hills. In southern Lycoming County, near Williamsport, some bud killing on apples was noted but no injury to trunks or branches was seen.

In the western part of Pennsylvania, around New Castle, about 60 miles north of Pittsburgh, there is a fairly well-defined, but narrow, transition zone extending east and west. Here the October frost was not so severe and the January drop was only 30 to 35 degrees. About half the bearing peaches were killed or seriously injured; old apple orchards escaped with little loss. In younger bearing orchards, especially those in cultivation, many Delicious trees had dead areas on the trunks. Baldwins were less seriously injured but showed weakened lower branches. In one orchard of York, three-quarters of the trees will die. Heavy fertilization and a large crop in 1935 were factors contributing to injury. This zone extends into Ohio where it includes the northern part of Columbiana and Mahoning Counties and then continues westward for some distance.

The small number of orchards and the rapid changes in elevation on the Allegheny Plateau in central Pennsylvania makes it impossible to secure a clear picture of the winter damage to fruit trees in this region. Orchards near State College, which is in the geographic center of the state at an elevation of 1200 feet, suffered only minor losses, except the orchard on the College farm. In general, losses in central and south central Pennsylvania seem to be associated with growth conditions above the average rather than with a lack of vigor.

In the eastern third of the state the upper areas of both the Susquehanna and the Delaware Valleys escaped with little damage from the winter of 1935-36. This includes the fruit region around Wilkes-Barre and Scranton. The first considerable injury to fruit trees in this part of the state is found on coming down from the Alleghenies into the Lebanon and Lehigh Valleys at elevations below 1000 feet.

In the Lehigh Valley south of the Delaware Water Gap in the vicinity of Easton, in Northampton County, peaches and sweet cherries showed some injury from the past winter but not as much as from the two previous winters. Eight to ten miles west of the river at elevations around 400 feet in a small percentage of the Stayman Winesaps and McIntosh trees the trunk bark split and sometimes rolled back.

Official minimum temperatures for Lehigh County on October 7, 8, and 9 were not much below 32 degrees F, but there were killing frosts on each of these nights which brought down some of the leaves and caused a heavy drop of fruit on the 20th of October. On January 23, 1936, the temperature in one of the larger orchards in the southern part of the county dropped from 37 degrees above to 6 degrees below zero. Apple trees in this orchard had considerable bud killing and some trunk bark splitting, chiefly on trees lacking somewhat in vigor or standing in spots of poor soil. Golden Delicious trees had much trunk injury under unbroken bark. McIntosh exhibited both bud injury and trunk bark splitting. Commercial sweet cherries had so much fruit bud injury that there was a very small crop. Peaches showed branch killing and some trunk splitting but had a fair crop in 1936.

Across the road from this orchard, a block of 16-year-old apples had been over-cultivated for many years until serious soil erosion had lowered the vigor of the trees. Here 200 to 300 Grimes, Stayman Winesap, and Rome trees had the trunk bark split wide open. A younger and more vigorous block of Stayman Winesap, Baldwin, and Delicious showed little injury.

Two miles away from these orchards, a large peach orchard had been fertilized for a number of years with 1000 pounds of chicken manure per acre per year. The trees were heavily pruned each year and some of them had made as much as five feet of annual growth. Ninety per cent of these peach trees showed excessive trunk cracking but had less branch killing than in nearby peach orchards which had not been pushed so hard. Injury was least in those parts of the orchard which were least fertile. This orchard was interplanted with seven and nine-year-old apples. Less than a dozen of these showed any signs of injury and then only slight trunk cracks.

In two large orchards north and west of Allentown at elevations of about 600 feet, alfalfa and clover sods have been used extensively and the soil is highly fertile. Less than one per cent of the trees showed either split trunk bark or dead areas under unbroken bark. Injured trees were scattered among several varieties but the heaviest loss was with Rome. Peach trees exhibited only a small amount of branch killing and produced a good crop in 1936.

In general in Lehigh County, apple orchards of average or better than average vigor had little or no injury; those on the poorer soils or in wet areas showed the most injury.

All through Berks County the roadside Mazzard seedlings escaped with little damage; some of them had a full crop in the summer of 1936. Some cherries had been killed or seriously injured by the two previous winters, 1933-34 and 1934-35.

Two large groups of orchards in the southern part of Berks County include over a thousand acres of apples and peaches ranging from recently planted to 18 years old. Elevations range from 400 to 1000 feet and the sites have excellent air and water drainage. These orchards have been well cared for, the soil is fertile and well supplied with organic matter from sod rotations. Although peach trees showed much twig injury, a very good peach crop was harvested in 1936. Between 200 and 300 apple trees show trunk bark cracking or slightly sunken areas with dead cambium under them. Rome, Golden Delicious, and Gravenstein showed the most injury. The owners thought that a southwestern exposure combined with slightly poorer soil was responsible for this injury. No particular fertilizer application or cultural practice seemed to be associated with an increased amount of injury.

A higher percentage of trunk injury on both apples and peaches was seen in an orchard along the Schuylkill River below Reading. Here excessive cultivation has resulted in heavy erosion and a low state of fertility in the orchard. Rome showed more injury than other varieties. Wet areas had more injured trees than those well drained.

North of Reading much of the injury attributed by the growers to the winter of 1935-36 was found to have been caused by previous winters. Less than one per cent of several thousand trees examined showed injuries due to the winter of 1935-36. Rome and Stayman Winesap both showed trunk and crotch injury. One block of McIntosh which showed much injury from previous winters also showed some caused by the winter of 1935-36. Peach trees had from two-thirds to a full crop in 1936. The only factor which seemed to be associated with apple tree injury was low vigor which was usually due to poor soil.

Halfway between Reading and Philadelphia on the Piedmont side of the last range of hills lies an area of local market orchards. This area is in a quarter circle centering on Philadelphia and running from New Jersey to the Maryland line. The apple and peach orchards are usually small—from 5 to 25 acres—and are mostly in sod or weeds. In these orchards the winter of 1935-36 caused almost no injury. However, when apple trees 10 to 20 years old in full bearing had received late cultivation or excessive fertilization, dead areas under unbroken trunk bark were common, especially on Rome and Golden Delicious.

The record in one orchard not far from the Schuylkill River near Norristown was especially interesting. The October frost had caused considerable defoliation and all varieties but Rome had dropped heavily around the 21st. These trees had always been rather heavily pruned and fertilized; in 1935 they received from 8 to 12 pounds of cyanamid early in March. At one time the orchard had been cultivated to a point where erosion was starting; since then it had been in clover sods, usually disced in the spring. Nearly all trees had a heavy crop in 1935. Eighteen-year-old Romes showed serious trunk injury from the winter of 1935-36 but some 12-year trees showed heavy injury from one of the two previous years only. Likewise, some Stayman Winesap and Jonathan showed trunk injury from the winter of 1935-36 and in one block, lower branches on Stayman Winesap and Yorks were dying. McIntosh, Grimes, and Baldwin showed little, if any, injury.

It seems highly probable that the excessive injury to Rome in this orchard and indeed in much of the state was due to the heavy crop and the fact that the fruit was not picked until November; it was the last fruit to be harvested. However, in addition to this factor, the orchard has been pushed harder by pruning, cultivation, and fertilization than most of the orchards in the county.

The performance of two nearby peach orchards is interesting. In both orchards the trees ranged from 8 to 16 years old and were of the same varieties. In the one, the orchard was cultivated throughout the early summer and seeded to rye in October; in the other, cultivation was stopped in June and a heavy growth of weeds covered the orchard through the winter. Where the late cultivation created conditions unfavorable for tree maturity two-thirds of the trees were killed or seriously injured. Where the heavy weed growth was undisturbed, there was no killing of trees and a good crop was produced in 1936.

In all the southeastern section of Pennsylvania, the study of winter injury to fruit trees due to low temperature in 1935-36 was complicated by trunk injuries caused by low temperatures in the winter of 1934-35. Typically these injuries produced dead areas covered by unbroken bark and many growers failed to detect this until the dead bark began to come off in 1936, so that the damage was attributed erroneously to the winter of 1935-36. The low temperatures of 1934-35 came on January 28 and February 7 when minimums of 15 to 18 degrees below zero throughout this section were from 9 to 12 degrees below those at State College and equaled or approached closely the record lows.

Very little difference in injury from the past year was found in the Cumberland Valley as compared to the valleys to the northeast. Although sweet cherries showed considerable damage from other winters, that of 1935-36 did not injure them enough to prevent many having a full crop the following summer. The smaller, 5 to 10 acre, apple orchards which are usually considerably neglected and in permanent sod, show almost no injury from the winter of 1935-36, though many lower branches are dying because of injury from other winters. On the other hand, in well-cared-for apple orchards, considerable injury seems to be associated with areas of poor soil which produced trees of low vigor. Also, there has been much heavier killing in low areas of peach, cherry, and apple orchards. There are likewise a few cases of winter injury to apples where too high a scale of fertility delayed tree maturity.

Injury to peaches in Franklin County in the lower Cumberland Valley will run somewhat higher than with apples. In general all peaches had some branch and bud killing, yet the county had about two-thirds of a full crop of peaches in 1936. Many trees show trunk bark splitting but otherwise seem in fair condition. Trunk splitting appeared to be more severe with vigorous peach trees while branch killing was greater with less vigorous trees.

Winter Injury in the Northern Panhandle of West Virginia and Ohio

There was considerable killing of apple trees in the northern panhandle of West Virginia and in eastern Ohio. Throughout most of this region the October freeze was as severe and the January drop was as

extreme as in any part of Pennsylvania. In most of the orchards here which were injured the factors responsible seemed to be those which delay tree maturity—heavy crop in 1935, late cultivation, heavy pruning, excessive fertilization or too low a plane of fertility and poor soil drainage. Exposure to the west and northwest winds has also been a contributing factor in this region but apparently not in Pennsylvania.

Summary of Conditions Which Caused Injury from the Low Temperatures of the Winter of 1935-36

The manifestations and the apparent causes of winter damage differed so from one area to another that, at first, the survey seemed only a collection of conflicting evidence, but as soon as it was realized that tree maturity was the one common factor the evidence became cumulative rather than conflicting. Hardly any of the injury from the winter of 1935-36 was due to excessively cold weather. Nearly all the orchards injured had been subjected to temperatures 10 to 20 degrees lower during one or both of the two previous winters.

Apparently throughout most of the northeastern states and into the Ohio Valley, fruit trees went into the winter of 1935-36 poorly matured. There was a heavy crop in 1935. The unseasonable freeze in early October injured the leaves and checked the normal maturing process. The sudden drop on January 22, starting from above freezing and going down to 10 to 20 degrees below zero, was too severe for immature tissues. The higher the initial temperature, the more rapid the drop, the lower the minimum, the greater the exposure to heavy winds when these low temperatures were reached, the greater the injury.

Tissues injured are those typically slow to reach maturity—the bases of the buds, the cambium of the inner portions of large crotches and of the lower trunk of most varieties, and the sapwood of the lower branches in Baldwin and Rhode Island Greening.

Trees were injured both because they were too vigorous and because they were too low in vigor. Excess fertilization, heavy pruning, late cultivation, thin soil, spray injury, heavy bearing, all caused damage to trees in one place or another.

In the case of Rome, late picking seems to have accentuated the injury and in a few orchards there was evidence that early pruning had caused damage.

Time and amount of fertilizer applications seem to have influenced the degree of injury only when they have increased or decreased the maturity of the trees. Source of fertilizer does not appear to have been a factor in modifying tree injury.

Suggestions. What can we do about it? Is injury from winter temperature something we must take when it comes or is it possible to mitigate such injuries by some modification of our cultural methods? Even in the areas of severest injury there were orchards which escaped with little or no loss; in all but two or three of the most severely injured orchards there were individual trees or even whole blocks which were uninjured while adjoining trees or blocks were killed. What caused such extreme variations? To answer this fully it would be necessary to study each variety and each block of trees and perhaps each

individual tree; however, through all the regions studied in Pennsylvania certain common factors seemed to be responsible for the major injuries. No two winters are exactly alike in the ways in which they cause winter injury so we need to assemble all the information we can from year to year in order to secure as complete a picture as possible, and thus to make any conclusions more certain and of the widest application.

Lack of maturity was the chief condition which made it possible for adverse weather to cause such damage last winter. Although the failure of large numbers of trees to reach a proper stage of maturity in the fall and early winter of 1935 was, to a large extent, due to the freezes in early October, this condition alone was not the responsible factor. Injury resulted chiefly when maturity was further delayed by other factors which are more under man's control.

Maturity follows when there has been a vigorous growth early in the spring and summer to establish a large and healthy leaf surface which can then produce abundant food reserves to stimulate healthy bud formation and to hasten the chain of events through which the tissues of the trees pass in preparation for winter conditions. A tree may fail to reach full maturity because it is either too vigorous or not vigorous enough.

Every cultural operation influences maturity and examples are numerous of damage which has resulted from each cultural operation we might mention. Consequently we should review all our orchard practices to determine what modification will aid in producing hardier trees.

Location. The chief cause of injury from low temperature not only this past winter but in all winters has been unwise location of the orchard. Poor air or water drainage, thin dry soil, restricted root area, excessive exposure to the cold winds, have only one method of control—plant the orchard in some other place.

Variety. The state over, there was no hardy variety during the winter of 1935-36, but in each locality certain varieties suffered more than others. When any variety, even such a hardy one as Spy or McIntosh, is taken out of the normal climatic range it is liable to have its normal maturing process upset. This is especially true when a variety is taken too far south of its best range.

Cultivation. Early seeding of the cover crop in the vigorous orchard aids in developing tree maturity. Stirring the soil for an early fall cover may delay maturity.

Fertilizers. Trees in low vigor may be made more hardy by increasing the fertilization or by using manure; trees in full vigor may be made less hardy by these same applications. Fertilizers which cause early growth and which do not produce available nitrogen late in the season are best to aid in maturity.

Cropping. Excessive cropping delays maturity especially with trees of less than average vigor. Thinning the crop saved trees in 1933-34 and 1935-36. The longer the crop stays on the tree the later the tree develops maturity. We must find ways of securing more regular cropping.

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Spraying. Healthy leaves are necessary to mature a tree. Defoliation from diseases or spray injury has permitted winter temperatures to kill many of our trees.

Pruning. In the winter of 1935-36 and in previous winters there have been a number of cases of heavy losses to trees pruned in the early winter when adjacent trees pruned later escaped undamaged. Why this is so we do not know but it raises a question of the wisdom of beginning pruning as soon as the fruit is picked.

FERTILIZATION AND MANAGEMENT OF ORCHARD SOILS

FIRMAN E. BEAR, American Cyanamid Co., New York City

When a man plants an orchard he should be thinking ahead for a period of about 50 years. During that period there will be extremely dry summers, and summers of excessive rainfall. There will be autumns when trees will have abundant opportunity to prepare for winter, and other autumns with sudden drops in temperature and very unseasonable weather. There will be mild winters, and winters of extremely low temperatures and drying winds. There will be years in which winter is long delayed and breaks suddenly into spring, and years in which the trees will begin their spring growth and later be caught by frosts. And, in due time, there will be the exceptional year—worse than any in the records.

Among the important points to be considered in preparing the trees to meet these abnormal conditions are: (1) the type of soil and the lay of the land; (2) the tree varieties and their rootstocks in relation to the soil and climate; (3) the time and method of planting the trees and their care during their early period of growth; and (4) the management and fertilization of the orchard, once the trees have gotten under way. This paper deals with the last of these problems.

I have carefully examined the experimental work reported by the horticulturists of the several agricultural experiment stations and have talked to hundreds of growers, including producers of apples, peaches, cherries, citrus, bananas, pecans, rubber, and a variety of other fruits, nuts, and other types of trees. As a result, I am impressed both by what we know and what we do not know about how to deal with orchard soils.

The one well-established and experimentally-verified principle in the management and fertilization of orchards is that of supplying readily available nitrogen regularly to the trees. This nitrogen may be that released by cultivation of the soil. It may be that supplied by the growing of legumes and their incorporation into the soil. It may be that applied in the form of manure or fertilizer. Whatever its source, the effect of making nitrogen available to the trees is always the same. Nitrogen always produces a marked increase in the diameter and length of terminal growth; in the size and number of leaves; in the size and number of fruit buds; and in the size and set of fruit. If a nitrogen deficiency is allowed to develop, there will be a marked slowing-down in the growth of the trees and a marked reduction in their fruitfulness.

If we do only one thing to the soil to make the trees more productive, that one thing should be to supply nitrogen every year.

Before leaving this phase of the subject it may be well to consider the trends in the use of nitrogen fertilizers. One of these is toward substituting nitrogen for cultivation. A second is that of changing from around-the-tree applications to broadcast applications. A third trend is toward applying the nitrogen in the fall (winter in the South) rather than in the spring.

This last trend, that of applying nitrogen in the fall, is now receiving a great deal of attention. Experimental evidence covering periods of 12 to 15 years, and large scale trials by orchardists during the last 5 years, have shown that fall application has a number of advantages and no known disadvantages. Fall application aids in getting the trees off to a better start in the spring, and in taking advantage of the better supply of moisture in the soil at that season of the year; (2) in overcoming biennial-bearing habits; and (3) in bringing the tree and the fruit through to maturity at an earlier date. There is also evidence that fall application aids in protecting the trees against winter killing, and against injury from spring frosts. Applying the fertilizer in the fall has the further very practical advantage of getting the job out of the way of early-spring work. Probably 25 per cent of the nitrogen used on deciduous fruits in the United States is now applied during the fall and winter months.

A second well-established principle of orchard-soil management is that of supplying large amounts of organic material. This may be in the form of a winter cover crop; a combination of summer and winter cover crops; or a permanent sod, with or without the supplemental use of hauled-in mulching material. Of these several methods, the growing of a well-fertilized permanent sod of grasses and clovers is the surest way of maintaining an adequate supply of organic matter in the soil. This method has very important advantages. It is the most economical. It stops erosion, by far the most serious enemy of fertile soils. It avoids competition for water by deep-rooted weeds and cover crops, particularly alfalfa and sweet clover. Many of the best orchards with which I am familiar have been in permanent sod ever since the trees were well established. These orchards are largely apples, but include peaches, cherries, and citrus as well.

Wherever grass can be made to grow satisfactorily, we believe the sod-cover system has every advantage and no serious disadvantages, particularly on rolling and hilly land. Proper treatment of this sod ordinarily consists in the use of more nitrogen; in clipping the grass and weeds with a mower, if required; in occasionally breaking-up the sod with a disc or springtooth harrow; and in applying phosphate, or phosphate and potash, to bring in the white, red, or alsike clover (*Lespedeza* in the South). The phosphate and potash should be applied in advance of discing the soil so as to get them down where they will do the most good, not only for the sod and the clover, but for any possible benefit they may be to the tree as well.

Grass sod is the great healing and regulating agent in orchards. In case of drouth, the grass, being shallow rooted, stops growth and the

tops die. In case of excess moisture or over-feeding, the grass grows very rapidly, thus offering effective competition for excess moisture and any excess of available nitrogen. Only in case of nitrogen deficiency, and particularly when the trees are young, does the grass offer too serious competition. This can easily be remedied by discing-up the sod in young orchards, or by using extra nitrogen in older orchards.

Unfortunately many orchards are located on soils that are too poor to grow grass and clover. In other orchards, the original fertility of the soil has been wasted by excessive cultivation accompanied by leaching and erosion. In still other orchards, the rows of temporary trees have never been cut out, the result being that the soil is shaded entirely too much and most cover crops will not grow. And finally, the use of acid-forming nitrogen fertilizers, sulphur dusts, and sprays, has resulted in making many orchard soils strongly acid. For these and similar reasons, the soils of many orchards are in no condition to grow their own organic material. In some cases these conditions can be remedied by the use of lime and mineral fertilizers. In other cases it becomes necessary to haul-in organic material grown on some other area. The practice of hauling-in organic materials is growing quite rapidly. It merits consideration by all orchardists.

At this point it may be well to consider the mineral needs of trees as distinct from their need for nitrogen. It is safe to say that over 90 per cent of the orchards of the United States receive no fertilizer treatment other than nitrogen. Those receiving phosphoric acid, potash, and other mineral fertilizers are the exception rather than the rule.

Examination of the experimental work with mineral fertilizers is disappointing. In many cases the tests were carried out without adequate consideration of the variations in the soil and the differences in the trees. The plots were not replicated sufficiently. The methods of application were not such as to be sure that any considerable amounts of phosphoric acid and potash were delivered to the roots of the trees. Phosphoric acid, in particular, does not move downward in the average soil to any appreciable extent but is fixed by the soil at or near its point of contact with the soil.

Considering all the evidence, it is my impression that no adequate case has been made for mineral fertilizers on fruit trees except on sandy, gravelly, and shaly soils. However, the mere fact that a soil is largely sand or stones is no assurance whatever that the trees growing on it will show any direct response to applications of mineral fertilizers. In fact, as recently shown in a report on fertilizing rubber trees, the evidence indicates that phosphoric acid and potash are likely to be most effective in the earlier stages of growth of the trees and before their root systems are well established. Once the trees have gotten a good foot-hold, fertilizer need reduces itself to nitrogen. Quick chemical tests of the portions of the leaves of the trees, which anyone can make, are useful in satisfying one's mind in this regard. On the other hand, it is seldom that the cover crops (particularly the clovers, either alone or in sods) growing on such soils are not benefited by phosphoric acid, potash and lime.

Judging by what agronomists know about this problem, it would seem that, if mineral fertilizers are to be satisfactorily delivered to the feeding roots of the trees in orchards growing on the heavier types of soil, it will be necessary either to use a mulch of organic material, thereby bringing some of the feeding roots of the trees to the surface where they can be fed; to plow the fertilizer under, or disc it down deeply into the soil; or, to make use of a soil augur or similar device for placing the fertilizer in holes bored into the soil under the spread of the branches of the trees. I have little faith in the usefulness of any ordinary amount of phosphoric acid and potash, if applied on the surface of the average orchard soil, insofar as any direct effect on the trees is concerned. I have a great deal of faith in the effectiveness of phosphoric acid and potash on the cover crops growing in the orchard, and possibly on the trees as well, if these fertilizers are applied in liberal amounts at the time the cover crop is planted, or if they are disced down into the soil, in the case of permanent sods. Certainly a handful of phosphate should be placed in the bottom of each hole when the trees are planted.

In my yard is a large oak tree which is probably 100 years old. It stands firmly on a bed of granite rocks over which there is only a very light covering of soil—barely enough to grow grass. To build a house, it was necessary to blast out the solid rock where the basement was to be. More than enough rock was thus provided for the foundation and for the first story. On such a foundation this tree flourished for at least 90 years, before the house was built, without receiving any fertilizer of any kind.

Somehow this tree, in spite of its hazardous location, has secured from the air, the rocks, and a little soil formed from these rocks and from decaying leaves, all the nitrogen and mineral elements it required to grow to its present size and to produce its annual crops of leaves and acorns. Fertilization by surface applications during the last 10 years has been of great help to the tree but I see no evidence of the effectiveness of anything except the nitrogen contained in the fertilizer.

My neighbor also has a large oak tree—almost a twin to mine—located on the same kind of rock, covered by about the same amount of soil. Last year he hired a tree specialist to care for his tree. The specialist bored holes in the soil and loose rocks under the tree and put complete fertilizer down in these holes. This fall, my neighbor's oak tree was in better condition than mine. It held its leaves longer. Possibly the feeding roots of his tree found their way to the mineral elements and absorbed some of them as well as the nitrogen.

I mention these oak trees for the purpose of emphasizing the fact that fertilizing trees with nitrogen, and fertilizing them with phosphoric acid and potash, present two fundamentally different problems as to time, method and frequency of application. Nitrogen, as soon as it becomes nitrate, is mobile in the soil. It moves readily either up or down, depending upon the direction of movement of the soil water. A surface application of nitrogen meets all the requirements. On the other hand, phosphoric acid and potash are fixed by the soil near their point of contact with it. The phosphoric acid will not move downward a quarter of an inch. The surface inch of an acre of average clay loam

soil has the capacity to fix a ton of potash. This potash may be gradually released and carried down into the soil by rainwater. Nevertheless, if potash applications are made to the surface of the soil, they will have to be quite heavy to be effective. Materials carrying phosphoric acid and potash should be placed down in the soil where they are close to the roots. The only exception to this is in the case of the sandier types of soil through which some movement will occur before fixation takes place.

Similarly, phosphoric acid and potash should be placed down in the soil, near the seed, at the time of sowing the cover crop. They should be cultivated deeply into the soil in the case of sod orchards. They need be used only from time to time as the appearance of the cover crop, or sod, makes their need apparent. When applied, the rate of application of phosphoric acid and potash should be generous, in order to more or less saturate the soil with them and with the hope of delivering the surplus directly to the feeding roots of the trees.

The excellent effects of hauled-in organic materials for mulching purposes may be due in part to their supplying considerable amounts of phosphoric acid and potash, particularly the latter, which are readily leached out of the dead plant material. The feeding roots, directly under or in the mulch, are in condition to absorb these leached-out mineral elements and to make the best possible use of them. The use of nitrogen and mineral fertilizers has important possibilities in the production of more and better materials for hauling-in purposes.

Before concluding, I want to stress particularly the seriousness of the problem of acid soils. Soil acidity is a menace in many orchards. When a soil becomes too acid, the cover crops do not grow luxuriantly; organic materials (cover crops, or sods) do not rot readily; and phosphoric acid is locked up by the soil in a form that is relatively unavailable even to the cover crop. The prevention of an accumulation of acid in orchard soils is justified if for no other reason than its very favorable effect on the growth of cover crops, particularly clovers, and its usefulness in effecting their decomposition once they are incorporated into the soil. An acid soil prevents full utilization of nitrogen, whether derived from cover crops or fertilizers. In many orchards, the use of lime would reduce the need for nitrogen, benefit the cover crops, and permit of longer life and greater fruitfulness of the trees.

THE HAIL INSURANCE PROBLEM

NORMAN W. WEBBER, Hartford Fire Insurance Co.,

Fellow sufferers,—I shall thus begin this talk due to the fact that 1936 caused hail losses of more than one-half a million dollars in the State of Pennsylvania alone. The insurance companies were also heavy losers, paying more than \$63,000 in hail losses on tree fruit only. Farmers in the United States annually suffer more than \$100,000,000 in hail damage, with a great many states receiving annually damage in excess of \$1,000,000.

Let us now digress a bit and define the reason for these hail-storms which cause so much loss to a farmer's income. Scientists explain the cause of hail in the following manner:

Hail storms usually occur during severe electrical storms or during an extremely hot spell. The reason for hail storms forming at this particular time lies in the fact that a rain cloud will descend upon a community and will begin to precipitate drops of water toward the ground which will in turn be caught by strong convectioning currents which are uprising heat waves. This force carries small particles of water into the stratosphere where they come in contact with sub-zero temperature which immediately freezes them. They are then pulled toward the ground by gravity and once more if the convectioning currents are strong enough, they are drenched with water in the rain cloud and again pushed into the stratosphere, thus accumulating various sizes depending upon the strength of the convectioning currents. When they have reached a weight which will overcome the uprushing air currents they fall in a bombardment of ice to the earth. Scientists have advanced many theories as to why certain localities are more susceptible to hail damage than others, but United States meteorologists say that few parts of the country are safe from heavy hail, and there is no way of knowing where it will strike next or how great the damage will be when it does occur.

Hailstorms of varying degrees of severity have fallen in various localities within the United States. One broke in 1927 in the State of Kansas where hail drifted to a height of from eight to fifteen feet. Naturally, any crop which was subjected to this punishment was a total loss. A loss similar to this occurred in the Township of Orrtanna in Adams County in 1936 when several farmers reported total crop losses. You can easily see that with farm crops suffering a damage of between \$75,000,000 and \$100,000,000 a year in hail losses that many farmers are forced to call upon various agencies for financial assistance. Hail losses in Adams and Franklin Counties in 1936 cost the insurance companies in excess of \$37,000 with hail losses for the entire State of Pennsylvania being in excess of \$63,000 for peaches and apples alone. Nearly \$130,000 has been paid fruit growers alone in the State of Pennsylvania for apple and peach losses during the last eleven years. Compare this loss to us with the probable losses sustained by farmers. A conservative estimate of hail losses in Pennsylvania to tree fruits would probably be \$250,000 annually. This would mean that during the last eleven years hail has taken from the farmers an income of \$3,000,000. It is not improbable that many of these losses were sustained by men who could not stand the financial losses caused by these hail storms and have, therefore, been forced to either neglect their orchards altogether or to partially neglect them and in some cases finally lose them altogether.

There are two things a fruit grower should carefully consider in deciding whether or not he should carry Hail Insurance.

FIRST: He should consider his financial condition. If hail were to damage his crop severely, would he be forced to borrow the capital to run his farm and produce next year's crop? I might also say that a great many growers who could financially survive a severe hailstorm carry Hail Insurance as a sound business-like proposition which will protect their present financial condition.

SECOND: What has been the experience of my orchard—the frequency and severity of hailstorms? Have I had hail damage which would have placed me in financial difficulties or has forced a curtailment of my normal expenditures for my orchard and home? It would seem to me that the answers to these questions will in part help you solve your problem of Hail Insurance.

Just last week a fruit grower in Massachusetts was telling me about the difficulties he got into three years ago. It seems he owned a small orchard but had a chance to purchase a large orchard nearby, which he did at a considerable expense. The first year he operated this new orchard hail caused almost a complete loss with the result he has been forced to mortgage his home farm in order to meet his obligations. As he put it—"I am now carrying Hail Insurance but feel like the farmer who waited until he had a horse stolen from his barn and then locked the door." If this man had protected his investment the first year he might have been today the sole owner of this orchard. Each of you growers has a different problem to face and you can only solve your individual problem by analyzing the facts concerning them.

I might say here that the rates you gentlemen are paying for Hail Insurance are promulgated on actual experience, which means that the premiums the companies receive for each County are placed against the losses they have actually paid in the respective Counties in the State. This accurately determines the susceptibility of the various Counties of the State to hail damage. The fact that during the last eleven years Pennsylvania fruit growers have purchased more than \$2,000,000 in protection against damage by hail shows that there is a definite need for this protection in the state.

Let us now proceed to insure a fruit farm which, for example, will consist of twenty acres of fruit in Adams County. The first thing to consider in coming to a conclusion regarding the advisability of carrying hail insurance is the expense you will go to in caring for your fruit orchard each year. The cost of spraying, pruning, cultivating, and otherwise giving your orchard the best of care will cost approximately \$50.00 per acre to bring fruit through to maturity. This cost of \$50.00 should be the least amount of insurance one should carry on fruit if the fruit set so warrants such an amount of insurance. Let us suppose that this twenty-acre fruit farm is made up entirely of York apples and that an exceptionally fine set is in prospect, and you decide to insure it at one hundred per cent to value. Your estimate of the crop is for a 6,000 bushel yield. Early crop reports would indicate that fruit will bring an average price of \$1.00 a bushel, a fair average on which to base your estimate. Thus you will need a \$6,000 hail policy or \$300.00 per acre. The cost of such a policy in Franklin County last year would have been \$360.00 or \$6.00 for each \$100.00 of insurance you buy. Incidentally, the insurance companies set \$300.00 as the maximum amount of insurance which can be placed on any one acre of fruit. Now suppose that hail comes rattling down some hot afternoon during a severe electrical storm. The first question you ask yourself is, "What shall I do about my insurance?"

The first thing to do is to examine your orchard carefully and estimate in your own mind the extent of the damage and place this in the notice of loss which you receive with your insurance policy and forward to the insurance company by registered mail. The insurance company may in turn advise your good friend, Professor F. N. Fagan, that you have suffered damage and he will make an inspection of your orchard and later make an adjustment when the fruit reaches maturity. Here I might say that a great many fruit growers differ with the insurance companies in that they ask for an early adjustment when hail causes damage to their fruit.

It is the experience of the insurance companies and their adjusters that hail marks on fruit will grow larger as the apples mature and if hail losses are adjusted later in the year, the fruit grower will get a much better and fairer adjustment than he would have gotten if the loss had been adjusted at the time of the damage, due to the fact that an adjuster will be able to know definitely the condition of the apples and to what extent they will keep after harvesting. When the adjuster finally arrives at your orchard to make the adjustment, he will go into the orchard and pick approximately one hundred apples from representative trees in various sections of the block insured. The number he counts will vary with the severity and uniformity of the hail storm.

(The following example to be worked out on a blackboard).

Let us now analyze one sample of the adjustment where the adjuster has picked one hundred apples from all sides of the tree and has dumped them in a pile ready to be graded. The Standard Tree Fruit Endorsement discloses the fact that for each apple that has been hit by hail and lowered one grade 35% damage shall be allowed. For apples which have been lowered two grades, a percentage of 70% of loss is allowed, and for apples which have been lowered three grades, to cider or evaporator stock, 90% to 100% damage. In the fourth pile the apples which have received no damage from hail will be placed. Thus if the damage shows that 45 apples have been lowered one grade, 15 apples are lowered two grades, and 35 apples being graded as cider or evaporator stock, and five (5) apples have no damage on them at all, the result will be a loss of 61.25%. Thus, if this owner of the twenty acres of York had

WHEN SHIPPING
FRUIT
THINK OF
ALBERT C. ROEMHILD
COMMISSION MERCHANT

122 Dock Street

Philadelphia

carried a \$6,000 policy on his orchard he would have received from this hail storm a loss of \$3,675, which with the amount of insurance carried should properly compensate him.

If there exist any questions which you would care to have answered, I shall appreciate your writing me in care of the Hartford Fire Insurance Company, Hartford, Connecticut, and I assure you that we will be glad to answer any questions you may send me.

BERKS-LEHIGH MOUNTAIN FRUIT GROWERS ASSOCIATION

J. E. LINDE, Sec'y, Orefield, Pa.

Following the meeting on March 17, 1936 and the subsequent organization of the fruit growers of Berks and Lehigh Counties, the Berks-Lehigh Mountain Fruit Growers Association was molded into an organization which has been profitable to its members. The organization is co-operative in nature.

The organization has for its goal the promotion of the best interest of the fruit industry in the territory, the establishment of a reputation for high quality fruit, and the maintaining of a marketing bureau. The association collects beneficial information by its continuous contact with potential markets and makes such information available to its members for their personal use in marketing fruit to the best advantage without price fixing. The association is neither a buying or selling organization but essentially a service organization for its members for more efficient marketing.

The membership in the association is entirely voluntary but is limited to the fruit growers of Berks and Lehigh counties and such additional fruit growers in nearby counties as may be accepted by a majority vote of the governing board. All members in good standing receive the same information relative to the markets and agree to protect the entire membership by reporting to the association any firm or individual who has defaulted in payments or contracts since December 31, 1933.

As previously stated, the association is not a buying or selling organization. Each member makes all decisions relative to the sale of his fruit. The annual membership fee is \$10.00. The expenses of the association are met by assessments levied on each member in proportion to the reported packed bushels sold wholesale. The assessments are based upon the grower's estimate prior to harvest and a report of wholesale sales when the crop is harvested. When this data is received the board levies its permanent assessment and adjusts all accounts with its members.

The association members are desirous of building up a reputation for Berks-Lehigh Mountain Fruit; consequently the association furnishes labels to be used upon containers of fruit grading U. S. No. 1 or better. Failing to comply with the provisions of the constitution and by-laws is cited as a violation. Any member found guilty of such a violation can be removed by a two-thirds vote of the board of directors.

The executive committee consisting of three members, the president being one, conducts the business of the association, such as employing

a manager, locating and maintaining a central office with the necessary facilities for proper and efficient operation.

A definite schedule is maintained for the collection and dissemination of information to members, so that early in the day the night's market prices, clean up, and future demands may be available to the members. Later in the day information as to the distribution of the day's pick or pack is available.

Initially the association was established for the purpose of promoting a more efficient marketing of early apples and peaches in the Berks-Lehigh territory. At the request of the growers the apple deal is also being handled by the association.

The association has been in operation about a year, but the service rendered the growers has been well worth the effort. Had the peach deal been unsatisfactory, there would have been little reason or demand on the part of the membership to insist upon continuing the service in order to market the main apple crop. A number of reasons could be cited as factors in the success of the organization, but undoubtedly the sincere team work of all the members and the capable manager who contacted the markets are paramount.

The growers were fortunate in being able to secure the services of Mr. J. G. White with his years of inspection service work and market contacts. Mr. White's first assignment in the newly formed organization was that of covering the principal markets to which the producing area ships its fruit. The purpose of this assignment was to make contacts, obtain information on the reliability of dealers and the possibilities of various markets. Mr. White visited Washington, Baltimore, Philadelphia, New York, Providence, Rochester, Boston, Buffalo, Cleveland, Pittsburgh, and a number of smaller markets.

The association has functioned smoothly and has been productive of excellent results, judging from the remarks of growers, many saying that they were more than pleased and that the small assessment to the association has been returned a hundred times over.

AN EASTENER VISITS NORTHWESTERN ORCHARDS

R. H. SUDDS, State College, Pa.*

It is to be hoped that in reading my would-be facetious reference in the Program to Mr. Fagan's preferring to raise sheep rather than to face the problems of the fruit grower in the Northwest, you do not acquire the wrong impression,—that I am trying to belittle either party concerned. It is not in my power to add or detract either to Mr. Fagan's reputation nor to that of your Northwestern competitors who show so much heroic courage in the face of titanic obstacles.

This summer I went to the Northwest to see for myself how things were; also I visited friends and former students now located there in the fruit industry. What I heard and saw made me marvel for there if anywhere in the history of fruit growing, men are putting up a magnificent fight against unfair odds.

*Now of West Virginia University, Morgantown, W. Va.

My first stop was at Spokane, capital of the "Inland Empire" of the Northwest. The Spokane Valley was once a thriving apple district which, however, was slowly declining for several sufficient reasons, until the autumn and winter of 1935-36 made practically a clean sweep in eliminating it. The northern Idaho districts met an identical fate.

At Lewiston, Idaho, and Clarkston, Washington, about 100 miles south and east of Spokane, is an irrigated area of several thousand acres in the Snake River Valley; here the fertile soil now is devoted to sweet cherries, peaches, and a large assortment of truck crops. Once this area was chiefly apples but now this fruit is comparatively rare; the only reason for its disappearance was that the apples could not be marketed to advantage. On higher priced land in a semi-arid climate such as this, unprofitable economic plants disappear quickly. To kill an orchard here, all that has to be done is to refrain from irrigating it for a comparatively short time; the end is never in doubt nor long delayed.

It was at Moscow, Idaho, the town where the Idaho Agricultural Experiment Station is located, that I saw twenty-five year old eastern black walnuts and apple trees getting along so beautifully side by side that I was moved to comment in print on it later. Hereby I started a discussion which is not settled yet.

Now for the famous central Washington districts. The Wenatchee and Okanogan districts produce over half of the entire apple crop of Washington State. Yakima, about 90 miles south of Wenatchee, is the next largest fruit district which is much more diversified than the former; here are grown apples, pears, peaches, apricots, plums, cherries, and a wide variety of vegetables. Some growers even have a cow or two. Wenatchee business conditions are a good barometer of the status of the apple industry; it is truly a one crop town. Yakima, the larger city, is not so subject to violent economic ups and downs. Conditions in the Yakima area did not reach quite the same rock bottom level as in Wenatchee. Yakima also has developed the by-product outlet considerably.

The men actually engaged in growing the fruit in central Washington are about sixty per cent college graduates, I was informed. They are generally alert, resourceful, and courageous individuals possessing unusual intelligence and tremendous capacity for taking terrific economic punishment which certainly has been meted out to them in large doses from 1931 to 1935, inclusive. Since my trip, every time I hear someone remark that Americans farmer are becoming soft and cannot take it, I turn back mentally to these fruit growers of the Northwest who can.

Most of the orchards are in relatively small units of from 5 to 15 acres. The largest operation I saw,—a company orchard,—was about 940 acres, but not all of this was located at one place. The usual ranch, as it is called, consists of a small bungalow type house, a garage, and one or two other small buildings, one of them being the stationary spray plant. There usually is no land lying fallow and the orchard occupies every available foot of good land.

At the exact hairline where the irrigation quits, the semi-desert begins with its monotonous sagebrush and worthless wastes. Most of the irrigation is by gravity, although it is necessary in the case of some

orchards on higher land to force water up a lift vertically equivalent to 300 feet. The annual per acre cost of water alone varies from about 5 dollars, in the case of some of the older irrigation developments, to more than 20 dollars in certain of the newer tracts. Sub-irrigation by water seeping from newer developments at higher levels has rendered some of the original land in the Yakima Valley unsuited for most crops because of its concentration of salts in the surface layers of the soil.

Water is applied to the orchard soil at intervals of about two weeks, for from 4 to 6 applications per season. It is the lack of more water which would limit much additional expansion of this irrigated orchard industry even if other economic conditions made it desirable.

The newer areas are farther and farther from the railheads,—another costly item to add to the overhead.

Cultural methods seem to have changed considerably from the old days of clean cultivation. The object now, I was informed, is to give the orchards little or no cultivation. Many of the growers drag down the biennial sweet clover cover crop or alfalfa sods rather than mow them. Any plant that will grow in the dense ground shade to be found in many of the orchards is quite welcome, for organic matter is necessary even for such wonderfully fertile and remarkably uniform soils, they have discovered. Another reason why cultivation is to be avoided is that it means a reditching for irrigation,—just one more item of avoidable expense.

Nitrogen in some commercial form is the chief fertilizer used, although thanks to the energetic activities of some of the fertilizer dealers, the picture presented to the growers is terribly confused,—quite needlessly and purposely so, I felt. As with us, potash and phosphorus in moderate amounts give some measure of response in additional cover crop or sod growth.

Propping of the apple trees is a universal practice and I counted many times more than 20 props under one apple tree. When the trees are often no farther apart than 27 feet, and when the numerous props are in place, a mature orchard looks very much like a very thick wood lot of fence posts when one squats down to peer along under the leafy canopy. No wheeled vehicle can get through under such conditions, which helps explain the stationary spray plants.

Many of these central Washington growers have never seen apple scab and some do not even know what it is; the hot and dry days of the growing seasons are not conducive to scab. But how they do favor the codling moth! Those of you who believe you have too much difficulty in controlling worms should visualize what the Northwestern growers must face every year, with some seasons much worse than others. A codling moth loss of about 10 per cent is expected during the usual season, and in some years half the fancy pack for the district may be lost just because of this single pest. Some growers may make only one slight mistake in attempting to outguess the worms, and as a result, the whole crop may be lost. And when a grower gives up the battle for any particular season and surrenders his orchard to the worms, his neighbors realize they too are in for it, because so often only the rancher knows

where his orchard ends and the next one begins; the codling moth simply does not bother making any distinction between adjoining orchards, other things being equal.

Northwestern spraying practices amazed me most of all, for according to their standards, we in the East do not spray at all,—we simply go through the motions. On trees where we would apply between 5 and 10 gallons, I found the spraymen busily whitewashing the trees with from 50 to 75 gallons per tree* at each application with about 3 pounds of lead arsenate per 100 gallons. The term "whitewashing" is not the exaggeration you might think and it is used advisedly, for some of it was just that. Even to attempt to control the codling moth in the worst areas may require from 7 to 10 such poison sprays! And the worst is that the end is not yet in sight, for heavier and heavier spraying is being required annually, I was told. No wonder some of the Yakima growers have torn out their apples and set other fruits. Some of the minor apple areas likewise have abandoned apple growing for the same reason.

This tremendous amount of lead arsenate applied annually is doing notable things to their soil, and to their cover crops and sods,—and even the trees in some instances. Many of the older orchards cannot grow a cover crop because of the concentration of arsenic in the soil. And when an old apple orchard is torn out to be replanted—often at the ripe old age of 25 years—the new trees have an unpleasant habit of failing to grow. This is giving much concern to the experiment stations in Washington and Idaho with no good generally practical remedy thus far discovered.

Again, since the apples are so heavily covered with residue, there is never any doubt whether or not washing will be necessary,—so nobody bothers to raise this question but rather assumes washing as inevitable. Chemists revealed that in some cases the lead arsenate coatings reached such figures that I could scarcely imagine such amounts adhering to the apple. Most of the apples are washed in tandem machines, first in acid, then in a basic solution, or sometimes the process is reversed, if necessary. At the American Fruit Growers' packing house at Wenatchee, 4 or 5 combinations of washing solutions are kept set up in their battery of washers.

When a certain lot of fruit is brought in, the packing house boss attempts to learn from the grower just what combinations of lead arsenate, oil or kerosene, soap, and other chemicals have been applied, then he attempts to wash a sample by a method which he thinks will reduce the residue as gently as possible. The washed sample is rushed to a laboratory and the rest of the fruit is held for the chemist's report which is made in an hour or two; if favorable, the balance then goes through the solution used on the sample; if the lead is still too high, trials must be made with other combinations of solvents until something does work. But if it seems to require too much time during the rush,

*The runoff even with these heavy applications is nearly plain water. A "Flocculated" Spray is used which sticks to the surface of the fruit in proportion to the adhesiveness of the "Flocs" and the amount of pressure with which they are applied. A coarse driving spray is used.

the whole lot is set aside to work on later at leisure. Once in a while, I heard, a given lot will not clean. Until one has seen the residue problem as it exists in Washington, he does not know the importance of this factor.

The red mite which all of you know so well is likewise a standard pest on the coast. Another insect,—the two-spotted mite, really a spider,—which you can thank goodness you do not know—gives them some severe losses at times.

Sulfur sprays are not used in summer except for the two-spotted mite, and summer oils are required on occasion for the red mite. I saw just as severe sulfur burns on fruit and foliage where it was used in Washington in the summer of 1936 as any of you had; where no sulfur sprays had been applied there was no burning at all.

The timing of the sprays in both Yakima and Wenatchee was done by field men working for the insecticide companies. It was quite amusing to me to see the work you here expect to have done by Mr. Hodgkiss and Dr. Kirby and their men from State College, being carried on just as carefully and conservatively there by the commercial fraternity. These field men are real experts on general orcharding affairs as well as in their line and can spot codling moth eggs on the fruits at surprising distances; they have to be accurate and conservative or else the next lot of lead arsenate will likely be sold to the grower by a quick-witted competitor. The growers in the Northwest buy materials only for one spray at a time, not for the season in advance, and merely a dozen companies are fighting for the business. I could continue considerably longer on their spraying problems which were a revelation to me.

Most of the total apple crop of Washington is shipped out, for the local markets so many of you are fortunate to have are seldom to be found in the Northwest. More than three-quarters of the total crop is Delicious, Winesap, Jonathan, and Rome. The future trend indicates a slight increase for Winesap and Rome, with a marked increase for Delicious. Jonathan will show a considerable decline as it has been unsatisfactory for several major reasons. While reliable estimates place the number of acres of apples pulled last winter in Yakima alone at more than 1000, the production will not decrease proportionately, because the acreage was chiefly poorer orchards already out of the economic picture.

The small number of varieties has created quite a pollination problem, for as in the East, Winesap is a poor pollinizer. Delicious is an excellent pollinizer for the others and in turn may be pollinated by Rome and Jonathan. Many varieties which are good pollinizers are very difficult to sell. Bees are either rented from professional beekeepers or are secured as package bees from Oregon and California.

Frosts are not a problem in Washington nor are cloudy dull days. The finish obtained is far ahead of what most of you in the East can equal.

Yields are completely out of line with those we expect normally. In order to stand a chance of being profitable, a Northwestern orchard must pack out consistently from 800 bushels an acre up, I was informed.

This is not impossible, for I saw one orchard owned by Mr. Roy D. Cain, Wenatchee, that had averaged 1165 packed boxes per acre per year for 14 years.

At the College, our heaviest yielding variety has probably been McIntosh which produced, orchard run, 700 bushels per acre in 1935 and about 500 per acre in 1936. In the Cumberland-Shenandoah Valley, yields of from 200 to 300 bushels tree run per acre are considered generally as a good yield. If it were not for such heavy yields, no apple industry could exist in the Northwest.

Beside the nefarious activities of the codling moth, your chief protection here in the East is the freight rates. In all my trip through the Northwest, this was the chief cause of complaint of the growers. The rate of one dollar a hundred to the Mississippi River and to a few points east of that, is a tremendous barrier, for in order to move their fruit, they must ship most of it east by railroad and pay at least a dollar.

The central Washington districts of Yakima and Wenatchee-Okanogan alone expend several hundred thousand dollars per year in advertising,—probably several times what the whole East invests in the same manner. The East, however, is showing some signs of casting off its lethargy and becoming slightly more awakened to its possibilities.

I discussed the situation with many well-informed people in the Northwest as to what is the future of that important apple growing section. These persons were well agreed that the chief hope for the Northwest to make any large general profit lay in having a heavy crop during years when the East was light. In seasons when the Eastern crop was normal, their profit would be confined chiefly to the Northwestern growers producing apples most efficiently. In years of gluts, quite likely only a few of the western growers would make anything. From 1931 to 1935, inclusive, only a few of the latter preferred group made money regularly and until this season, the condition of most of the growers was deplorable. Most of the orchards were said to be mortgaged to the hilt and how long the owners can continue to lose money is a question nobody can answer. The season of 1936-37 brought some degree of encouragement; a few good seasons in succession will help set the Northwest back on its feet. Several more bad ones hand running will likely do more to reduce the Northwestern apple industry than any plan of crop limitation and reduction planned by man.

Most of you in Pennsylvania are lucky and I hope you begin to realize it soon if you do not already. However, do not rest on your oars in your plans to grow, market, and advertise better and better grades of superior varieties. Your Northwestern competitors are still dangerous and with even a fractional opportunity, they will give you plenty of the severest kind of competition; with anything like an even break, they will practically steal your show as many of you are now plodding along, indifferent to the changing apple world about you.

All respect then, to the apple growers of the Pacific Northwest! Just to hear of their gallant fight against great odds is to admire them and to know them and their problems first-hand is merely to intensify one's admiration of their courage.

BASKETS of CHARACTER

Have you noticed on the streets in our receiving markets that baskets closely portray human nature? Many of them, beaten in their endeavor to perform their duty, have drooped shoulders, misshapen feet, broken backs and hairy, haggard faces.

Other baskets portray real character in their straight shoulders, their excellent carriage and their clean-shaven, smooth appearance. These baskets stand out in front—not bent, not broken in the performance of their duty, they proudly display their protected contents and their name, "MARVIL U. S. No. 11."

◆
"Marvil Products
Protects Contents"

◆
MARVIL PACKAGE CO.
LAUREL, DELAWARE

ORCHARD BEEKEEPING

GEO. H. REA, Cornell University, Ithaca, N. Y.

There is no longer doubt as to the efficiency of honeybees as cross pollinating agents for fruit bloom and in fact their absolute necessity has been established for many orchards. In many fruit growing localities the wild insect population is entirely inadequate to properly work the great number of fruit blossoms in the short period of time in which this is necessary. Apparently there has been a marked decrease in the wild insect population in many sections in recent years, because of clean cultivation of the soil and cleaning up of the wood lots where the solitary bees and other useful insects make their nests. Since it is not possible to propagate the wild insects and have them in abundance in the orchards at the right time, we must turn our attention to the honeybee which has a high commercial value in the honey crops which it harvests and which can be reared in as large numbers as desired and placed in the orchards when needed.

It is not the purpose of this article to attempt to induce all fruit growers to keep bees. This would be foolish propaganda because there are so many factors involved that the average fruit grower would only lose his investment if he should attempt to keep bees. The bees must have certain attention at the right time and if this attention is not given at that time failure is likely to result. Since the business of the fruit grower is to care for his orchard and the fruit crops, a comparatively minor detail like working over a few colonies of bees when there are big things to be done is likely to be neglected. Some persons are highly susceptible to bee sting poison and many are so much afraid of bees that they cannot work with them. Such persons should not think of keeping bees.

Most fruit growers prefer to rent colonies of bees from reliable beekeepers who supply bees for pollination purposes as part of their regular beekeeping business, or to purchase package bees from the South each spring. These phases of the beekeeping industry are growing and for a very large portion of the fruit growers will be the continuous sources of colonies of bees for their orchards.

However, there are some fruit growers who derive a lot of pleasure out of keeping their own bees and prefer to do so rather than to depend on someone to supply the bees when needed. Orchard beekeeping has some advantages and some decided disadvantages. The chief advantages are that the bees are there when needed and at no greater cost than rented bees, some honey is harvested for use by the family and sometimes for sale, and the beekeeper has a delightful avocation. The disadvantages are that it is another detail to be looked after when the fruit grower may lose more than is gained if he stops to give the bees attention; bees left in the orchard are often poisoned by spray or dust; they sometimes are objectionable to members of the family or to the workmen and may sting animals if placed near the buildings, and in some seasons in some locations the bees may not gather sufficient honey to keep them over winter, and additional labor and expense is involved in feeding them.

Simple Beekeeping Methods Necessary

The necessity for colonies very strong in field bees at fruit bloom time cannot be over-estimated. Since this is the main objective in orchard beekeeping the beekeeping practices of the whole year must focus on this one point. To acquire these maximum colonies, five main factors must be present for a period of at least eight weeks previous to the time of fruit bloom. These factors are a good sized cluster of young bees, a prolific queen, plenty of honey and pollen stores, plenty of room for stores and brood-rearing, and plenty of insulation. These things cannot be supplied at this time but must be provided at the time or previous to the time when the bees are packed up for winter in the previous October. Methods for accomplishing these things are not difficult but are seasonal and would be better taken one step at a time during the summer and fall. The use of the two-story Langstroth hive is urged so that the fullest egg laying capacity of good queen bees may be utilized. It is best to requeen the colonies each year so as to offset heavy losses which may occur from failing queens. In most localities if the beekeeper supplies the queen and plenty of storage room for all of the honey which the bees may gather during the summer, leaves plenty of honey for the bees in the fall, and adequately insulates the hives before freezing weather occurs, the matter of a good cluster of bees and the satisfactory progress of the colony in the spring will normally occur.

Securing and Using the Bees

Fruit growers who wish to rent colonies should contact those who have bees to rent at an early date so that there will be no slip-up when the bees are needed. Weak colonies are useless and normal colonies should have at least six combs of brood and the rest of the combs well covered with bees at fruit bloom time in order to be called a good colony. Experimental work by several workers has proven the comparatively high value of strong colonies over weak colonies in their ability to fly and work on blossoms especially in low temperatures.

Colonies should be moved into the orchard if possible a day or two before the first blossoms open so that they will be present every minute of the possible time when work may be done. This is especially true in sections of the country like western New York where much of the weather during fruit bloom may be cool and cloudy. In this region it is highly important that the bees be well distributed through the orchard rather than to be located in groups or in one apiary. In many seasons the bees never have weather favorable for flight farther away from the hives than two or three rows of trees during the entire period of fruit bloom. In sections where weather conditions are more favorable it may be possible to have good work done by the bees when they are placed in groups in or around the orchard. It is better to play on the safe side and have the bees well distributed throughout the orchard than to take chances on a poor set of apples by saving a little labor in distributing the bees. Seasons vary greatly in the amount of cloudy and cool and windy weather and it is best to be prepared for the poorest bee flight conditions. Sunshine and fairly high temperatures are essential to long bee flights.

Package Bees

Package bees should be ordered from the southern shippers several weeks ahead and they should arrive before fruit blossoms begin to open. It is best however, not to have them arrive too far ahead of time. On arrival they should be installed in hives and fed according to instructions, or if the packages are designed to be set out in the orchard they should be wrapped to insulate them and fed as instructed. It is best to install package bees immediately on the stands out in the orchard, where they are to remain for the period of fruit bloom at least. When package bees are purchased for making a start in beekeeping the new hives should be made ready sometime ahead and placed on the proper locations so that there may be no delay when the bees arrive. Full sheets of brood comb foundation should be used in all of the frames so as to insure the building of all worker combs which will be straight and easy to manage. It must be remembered that the new swarm of bees has no fully constructed combs nor a stored supply of honey on which to draw for their living and to build new combs. They must depend upon nectar and pollen gathered from the flowers but because of bad weather conditions or because the flowers are not in proper condition to secrete nectar, they may starve unless the beekeeper continues to feed them until they are well established and have a honey supply of their own stored in the combs. Feeding instructions always accompany package bees. For this purpose a syrup of about one part water and one part granulated sugar is used. Three pound packages with queens are usually purchased.

This has been a hard winter on bees, especially if they were not well insulated against the cold. If colonies have died and one is sure that the combs are not infected with American foulbrood, it is an easy matter to restock these hives with package bees. In case the hive contains a lot of dead bees and the combs are moldy, it is best to clean out the dead and scrape the hive generally clean of debris. The new swarm of bees will utilize any partly sour honey that may be in the combs and if there is sufficient honey, feeding will not be necessary. Package bees are very useful to unite to weak colonies in order to bring them up to good flight strength at fruit bloom time. This is a good time to replace failing queens or undesirable stock in the bees. Package bees with queens are ordered. On their arrival the queens in the colonies are found and killed. One extra and empty hive-body is on hand for each colony. One comb containing some honey and brood is taken from the colony and placed in one side of the empty hive-body, a single sheet of newspaper is spread over the top of the combs in the hive and the empty hive containing the one comb is placed on top of the newspaper. The caged queen is taken from the package, as the instructions should indicate, and the cage placed on the comb. The package is then placed down into the empty hive and the cover taken off, after which the hive cover is quickly placed over the hive. In a few days pieces of the newspaper will be thrown out of the hive entrance. After this occurs, the hive may be opened and the bees concentrated down into the lower hive. In case the colony is strong enough to occupy two hive bodies, the second one should be given at fruit bloom time.

Moving Bees and Where to Locate Them

Beekeepers who move bees to the orchards frequently complain that they suffer heavy losses because of queenless colonies and the loss of brood. In some cases this has been so serious as to cause the loss of almost the entire honey crop from these colonies. Not all of the factors which bring about these losses are known but if proper precautions are taken the most of it is preventable. When strong colonies of bees are distributed for a long period of time, as in moving on a truck for several miles, the activity within the brood-nest sends the temperature soaring and ample room for the expansion of the cluster and ventilation must be provided. No doubt but that much of the brood losses come from overheating. Moving at night or in cool weather is desirable and very often can be done. Even then ample screens should be provided for the tops and the bottoms of the hives. The frames should be fastened up so that they will not bounce around and kill many bees and perhaps the queens. In spite of these precautions many colonies are seriously damaged as far as future honey production is concerned.

Moving the colonies a short distance, as from a central location near the buildings to be distributed through the orchard, presents another problem. After moving it is usually found that many of the field bees have returned to the original location where they die, unless a colony is left for them to enter. If two or three weak colonies are left behind to catch the returning field bees from a small apiary no serious loss of field bees will be experienced except that the colonies which were moved will not be strong in field bees for a few days. If bees are moved within their flight range, which may be one or two miles, most of the field bees will return to the original location.

Bees usually should be moved more than two miles when possible. A good way would be to move them away from home a distance of about three miles and leave them there for about two weeks, after which they may be returned and distributed where wanted. Since this is not always convenient, it might be suggested that two fruit growers living three or more miles apart swap bees for the time of fruit bloom. Some beekeepers report satisfactory results by catching the returning field bees in empty hives left on the original stands. After night they are carried out to the colonies in the orchard and united back to them by using newspaper. This is done by removing the cover from the colonies and placing single sheets of newspaper over the frames. The empty hives containing the bees and without bottoms are then placed over the newspapers. After the bees have taken time to cut through the paper they seem to forget the old location.

If at all possible, bees should be located where they will be well protected from prevailing winds and at the same time have the full benefit of the sunshine. Bees in windy locations and especially if they are in the shade will lose a lot of time because it is too cold for them to fly while colonies in the sunshine and protected from wind will be working. This applies to bees temporarily located in the orchard as well as to permanent apiary locations. Rented bees should be removed from the orchard before the petal fall spray is applied, so as to prevent poisoning. Bees kept in the orchard during the entire year frequently collect poison.

In some cases this results in the death of the colonies, while in many cases only the field bees are lost and the colonies subsequently build up and become good colonies for the next spring.

CONTROLLING SOIL EROSION AND WATER RUN-OFF IN THE PENNSYLVANIA ORCHARD

By J. T. BREGGER, Project Manager, U. S. D. A. Soil Conservation Service, Waynesboro, Pennsylvania

Until quite recently, we have worried little about erosion in the United States, largely because we have thought in terms of geologic erosion. Geologic erosion has helped to make much of the soil which man-made or accelerated erosion is now destroying. Since America first settled, approximately fifty million acres of fertile land have been ruined by erosion, while fifty million acres more are almost destroyed. Still another 125 million acres or a third of the total land under cultivation have lost between 50 and 100 percent of their surface soil through sheet erosion, with an additional 100 million acres showing some erosion. Due to the fact that every square foot of sloping land in a humid climate is subject to erosion, it means that 95 percent of our orchard land needs protection of some kind.

It is not so much a problem of decreased acreage which is facing the U. S. fruit growers, but rather the fact that some of the best and most fertile land is being rendered unsuitable for further orchard use. This is particularly true from the standpoint of the peach grower, as often the best peach land is located on slopes subject to severe erosion when not handled in the correct way. Northwestern fruit growers, partly because they can substitute irrigation for rainfall, are conserving their orchard soils much better than those in the East.

Although many orchards in the South are exposed to erosion all 12 months of the year and thereby have become badly damaged by gully erosion, soil and fertility losses in the North may in some cases be almost as great. Small gullies so common between the tree rows become filled with fertile soil in the process of cultivation and it is this soil which is washed out with the next heavy rain. Eventually the trees may even be left on small islands of soil, in some cases exposing tree roots or, at best leaving very little cover. Many tons of valuable soil may thus be lost from these orchards annually, not to mention the rainfall lost during the growing season when adequate soil moisture is needed by both tree and fruit.

In California, erosion has resulted in the ruin of orchard land valued at 300 to \$1,000 per acre. While the value of the ordinary peach orchard site in the East is less, the destruction of such land by erosion demands immediate consideration.

The rapidity of erosion in an orchard may be directly correlated with the type of soil management being practiced. In other words we may have, and we do have, the two extremes of erosion severity under orchard conditions.

Under a permanent sod, the common ground cover in apple orchards of most eastern and western states, erosion has probably been little or

no greater than exists upon other grass or pasture land. The orchards of the Pacific Northwest, for instance, under a more or less permanent alfalfa sod, do not have an erosion problem. Even when the grass or sod is broken up each spring but allowed to grow up again immediately little or no physical loss of soil or fertility takes place.

On the other hand, we may have our severest erosion under orchard conditions, and we find such a condition in the peach orchards of many sections of the country. This means, of course, that the entire top or fertile soil layer of an orchard may be completely lost during the lifetime of that orchard, ranging from 15 to 20 years. Erosion of such severity is too common and its importance or danger cannot be overstated.

It must be acknowledged that ordinarily we cannot avoid the easily eroded types of land in choosing peach orchard sites. In other words, peach trees require good water and air drainage, such as our hilly and sloping lands usually afford. The solution of the erosion problem lies therefore in the manner in which such land is handled rather than in choosing another type of soil and a different location.

In general there are two ways in which rainfall may be prevented from causing erosion. The first of these is to prevent accumulation of large quantities of water in one place, while the second is to slow up the speed with which the water runs over the surface of the soil. In dealing with the correction of these two causes of water erosion, we usually speak of the mechanical and vegetative methods of erosion control.

The prevention of water accumulation is largely an engineering problem. While it may not always be possible to prevent water from coming into an orchard from the land which lies above it, there are methods which can be used to take care of this water before it enters the orchard. A so-called diversion ditch may be used to accomplish this.

When it comes to handling the rainfall which falls on the orchard itself, unless the slope is too long, we become largely concerned with the necessity for slowing down the speed of the run-off. Whenever the accumulation does occur at any point, diversion of this excess water is also of importance.

The speed with which water flows determines to a decided degree its soil-carrying power. If we consider a very important formula in hydraulics, we find that under field conditions the transporting power of water varies approximately as the fifth power of its velocity. In other words, water moving at the rate of two miles per hour, will carry 32 times as much soil as it can carry at one mile per hour. How to slow up this flow of water, once our rainfall reaches the land, is the all important problem, and therein lies the need for the practical methods of modern erosion control.

Unfortunately most of us have certain prejudices or traditions to "unlearn," whenever we try to change a set of practices in regard to the culture of any given crop. The fruit grower, like the people in all other walks of life, has been handicapped by tradition. For example, he has been planting **round** hills on a **square** system. Although the best method for planting orchards on sloping land may be to follow the contour of the hills, few orchardists in the eastern states have seen it done that way, and consequently even the most progressive fruit growers

still use the old square system. As soon as the benefits of contour planting become better known—both the economy in the use of horse or tractor power, and the greater conservation of soil, water and fertility—there should be a decided change in the direction of contour planting.

Few orchards in America are planted on the contour. And yet it is a very simple matter to plant a new orchard in this manner, and to terrace it also if the soil is suitable. In fact contour planting goes hand in hand with terracing, although it may be done without terracing under some conditions with success. In California, the general recommendation is to contour plant orchards on slopes ranging above four percent, using bench terraces with permanent vegetative risers on slopes greater than 14 percent.

The terrace is probably the outstanding example of mechanical erosion control. In its application to orchard use terracing may have several variations, though the general principle remains the same.

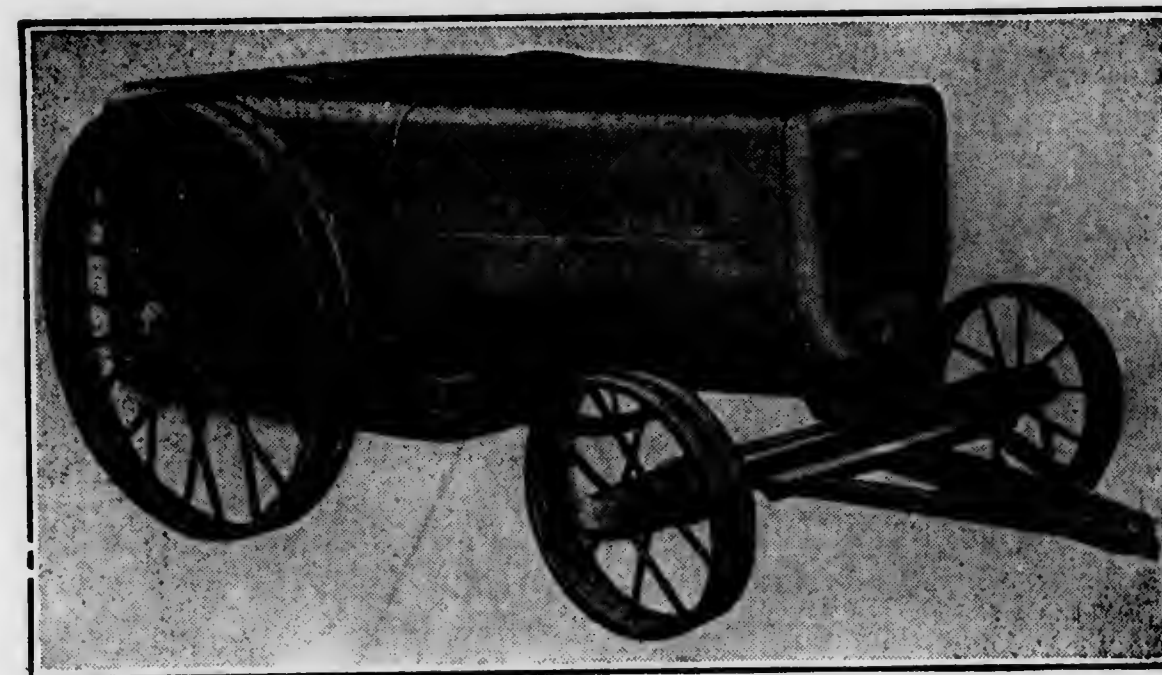
There is evidence that terraces were used by the Mayans and the Peruvian Indians as long ago as the dawn of American history. A system of terraces begun 4,000 years ago by the Igorotes of Ifugao in the Philippine Island has been improved and extended even to the present day. Terraces of the bench type are used on the steeper lands of Germany, China, and Japan and by the planters of Java and Sumatra. They have been recognized as an accepted agricultural practice in the South for more than 75 years, but only a few widely scattered examples were to be found in the Northeast, up to the time the Soil Conservation Service began putting on terracing demonstrations. At least two of these older terrace systems, however, were constructed for orchards and in both cases they have proven highly satisfactory. Terracing is easiest as applied in the establishment of **new** orchards since there is then an opportunity to make every tree row a terrace. Such terraces need not be very large, as the water-holding capacity need only be great enough to hold the maximum rainfall which occurs on the average 20 or 25 foot interval between rows. After the accurate laying out of the tree rows—either on level terraces if the rows are short, or with a slight gradient (0.1 to 0.3 foot drop per 100 ft.) if the rows are long—an ordinary plow may be used to build the terrace high enough to allow planting of the trees. As time goes on, the terraces are maintained by additional plowing toward their crest or “berm” or by the use of a home-made “V”-type drag.

In its demonstration work on the Waynesboro, Pennsylvania, project, the S. C. S. has also used a method of terrace construction whereby every fourth or fifth row is terraced at the standard narrow or wide-base terrace size, serving in this capacity as a “master terrace.” In this way any abnormal thunder showers or cloudbursts are prevented from causing water run-off which might occasionally break through the smaller intervening terraces before they become fully established and settled. Such a terrace at the top of the slope would also serve to intercept overflow water which might run into the orchard from the field above. A simply designed diversion terrace will in such cases save untold soil losses and prevent the formation of the gullies which are a constant source of inconvenience in the performance of all orchard practices, involving the use of heavy machinery.

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Regular terracing machinery may be used in orchard terracing, but such machines have their limitations, particularly in the orchard which is already established. The original cost of such machinery in many cases might be reduced by cooperative purchase and use by a large number of fruit growers, sometimes already together in an association for the purpose of marketing fruit or purchasing supplies.

The problem of terracing is naturally far different in the case of orchards already planted as compared to those to be newly planted. The use of terraces in established orchards is being tried, however, in cases where soil losses have been severe. Such installation usually requires the removal of a certain number of trees, especially if the terraces are large or put in with large machinery. On the other hand, if they are small and close together it may not be necessary to remove any trees, though in such cases the terraces or furrows are more temporary and must be reconstructed annually. There is need for much experimental work in this kind of terracing, however, before it can be determined definitely how much benefit will accrue to the remaining trees through the conservation of soil and water to offset the loss of the trees removed and the expense of construction.

Vegetative Control and Erosion

The principle involved in vegetative control of erosion concerns the decreasing of the speed with which water travels, so as to reduce its eroding power to the minimum and allow for a maximum penetration and conservation.

The types of cover crops used in commercial orchard practice are varied, but may be divided into groups on the basis of their effectiveness in controlling the flow of run-off water and resisting soil losses. On the one hand we find thick blue grass sod almost perfect in this respect. At the opposite end of the list we have buckwheat, showing little or no efficiency in erosion control. Fortunately for the apple grower, his normal soil management program in most areas includes a permanent sod or cover. This may involve cultivation for only a brief period in the late fall or early spring (sometimes only once every other year) for the purpose of correcting a sod-bound condition and in order that the benefits of nitrate and other fertilizers applied will be fully and quickly available to the trees. The alfalfa sod in the orchards of the Northwest serves the same purpose as the bluegrass or sweet clover orchard covers in the Northwest, and of the Korean lespedeza cover crop in the Southeast.

Sod culture under Pennsylvania conditions is limited almost entirely to apple orchards, although alternate rows or buffer strips of a permanent vegetative cover are sometimes used in peach orchards. For many years most of the commercial apple growers in this state have been practicing a system whereby a permanent sod cover is maintained throughout the period of the year when erosion can take place, thus conserving their soil resources to the maximum. In New Jersey and a few of the adjoining fruit areas, however, the apple orchard is cultivated much the same as a peach orchard, and under such conditions, especially

when orchards must also contend with sandy soils and torrential rains, it has been found difficult to secure adequate erosion control through vegetative methods alone.

As in the case of farm pasture, improved growth of sod in the orchard will result in better erosion control. The fruit grower should therefore apply sufficient lime and phosphorous, when these are lacking, to increase the growth and thickness of the cover crop and thereby effectively conserve soil. Leguminous cover crops particularly respond to such applications with excellent results.

For some reason the idea is prevalent among fruit growers that peach orchards **must** be cultivated, **frequently and continuously** throughout the growing season of the tree and fruit. Such a practice has of course been largely responsible for the severe erosion found generally in these orchards. Furthermore it has been noted many times that non-cultivated orchard trees on good soil show more tree growth than cultivated trees on eroded soils.

The average peach grower objects to the early seeding of a cover crop because he believes such plants tie up too much nitrogen and compete too strongly with the trees for soil moisture. These difficulties, though usually magnified, may largely be overcome by following a slightly delayed planting of the cover crop after the early spring growth period when trees demand the most nitrogen, and later by mowing the cover crop during the dry summer period when there is not enough moisture for both trees and cover crop. This clipping of the cover crop will further aid erosion control, and result in greater water absorption by the mulching effect which it produces.

Experiment at Pennsylvania State College have already shown that the cultivation period of a peach orchard planted on deep soil may be shortened to accomplish little more than a complete preparation of the ground in the early spring. Any competition of the trees and cover crops after that period may be settled in favor of the trees, not by cultivation, but by mowing of the cover crop. The confinement of cultivation to alternate rows is another method which demands further investigation, as occasionally this practice has been observed in orchards and little or no injurious effect on the tree or fruit crop has resulted.

The use of cover crops for peach orchards presents no easy problem. A cover crop must be found which is not too deep-rooted and will make fairly rapid growth of a spreading nature in order to quickly cover the ground after it is sown. A crop which may be mowed in case of dry weather is preferable, though in most cases cover crop plants are so shallow rooted that the soil moisture which they require would be a negligible loss to trees. Moreover crop plants suffer from dry weather sooner than trees and in some cases they conserve more moisture by preventing run-off than is utilized for growth.

Cover crops which have been used in peach orchards during the past year in soil conservation demonstration work include millet (golden millet seem to be the preferable type), Sudan grass, crimson clover, rye, and hairy or winter vetch. In some cases millet or Sudan grass has been mixed with soybeans or cowpeas, which by themselves, like buckwheat, are poor cover crops for erosion control.

Cover-crop management should take into consideration the growth periods of the fruit. Several State experiment stations have determined that the Elberta peach, for instance, has its first period of fruit enlargement during about 50 days following the blooming period. During the next 30 to 35 days, very little growth or enlargement takes place. Then the second period of growth extends during the last 40 to 45 days before harvesting. The cultivation period of the peach orchard needs therefore extend only to approximately the end of the first growth period, it will not have made any appreciable growth by the end of this time. The only important competition from trees would be during the last period of fruit growth, at which time the mowing of the cover crop could be resorted to if dry weather prevailed.

In the use of the cover crops noted two so-called cover crop "systems" may be employed. For the sake of simplicity, we have called these the single and double cover crop systems. In the case of the former, more commonly found in Pennsylvania, the millet or Sudan grass (with or without soybeans), or crimson clover which is sown in late spring or early summer is allowed to remain on the ground until the beginning of the cultivation period the following spring.

In the double cover crop system, recommended for instance in Maryland, there are two seedings of cover crops each year. Under this plan, rye with or without vetch is planted in August or September, to be plowed or disked under the following spring when it is 15 to 20 inches high. This allows a considerable amount of plowed-down vegetation to remain on the surface where it will help prevent erosion during the brief cultivation period which usually exists until some time in June when a soybean crop (preferably with millet or Sudan grass) is planted and allowed to grow until late summer, when rye is again seeded.

Where Korean lespedeza grows well, it makes an ideal erosion-resisting cover crop, if not allowed to compete with the orchard during periods of low moisture supply. Such a plant is also very good for use on steep slopes as a more or less permanent cover for every second, third or fourth row parallel to the contour of the hill. These so-called buffer strips may be moved each year to facilitate distribution of additional organic matter to the soil and at the same time aid in the control of erosion.

There are of course modifications of the above cover crop systems. Furthermore, there is a good auxiliary erosion-control measure which involves bringing in a certain amount of mulching material from outside the orchard. This may be hay or straw which, if applied properly, will effectively slow up the flow of water and keep the soil from being washed away during the heavy rains. Spoiled alfalfa hay or strawy manure makes good mulch material because they add fertility and organic matter to the soil as well as prevent erosion.

While the cost of the foregoing soil and water conservation program is negligible compared with its value, it not only makes possible increased fruit yields during the life of the orchard on which it is practiced, but will actually prolong the life of the orchard. Moreover, it will keep the land fertile for the next crop.

Many an orchard is short-lived simply because the soil is gone—rendered unfit for other crops until years of a building-up process makes it productive again. Soil conservation is far more economical than soil building.

Water and soil conservation go hand in hand. During a dry season they may actually mean the difference between profit and loss.

FRUIT GROWING IN EUROPE

S. W. FLETCHER, State College, Pa.

My horticultural observations in Europe were restricted to Great Britain and Ireland, northern France, Belgium, Holland, Germany, and Switzerland. Any comparison of the fruit growing of Western Europe with that of Pennsylvania must take into consideration the marked difference in climate, which is due mainly to the influence of the Gulf Stream. The climate is much more equable than that of Pennsylvania; the summers are cool and the winters are mild. Sunshine is at a premium all the year. Although the British Isles are farther north than Newfoundland, they have a climate as moderate as that of coastal South Carolina. The winters of southern England are almost frostless.

Climate and Fruit. This difference in climate is reflected in the types of fruits grown. The summers are too cool for the peach; this fruit can be grown only when trained against the sunny exposures of walls or buildings which reflect heat. Sometimes peaches are grown in cold frames or in greenhouses. No wonder they cost 15 to 25 cents each. If European countries would allow American peaches to enter at a reasonable tariff, we could build up quite an export trade.

The cool, humid summers are favorable for the culture of the pear, cherry and plum, which thrive here somewhat better than in eastern United States; but the apple, while widely grown, is distinctly inferior to our product. In this even-tempered climate the small fruits—especially currants, gooseberries, red raspberries, and strawberries—attain a degree of excellence that we reach only in western Washington and Oregon where somewhat similar conditions prevail.

The coolness and humidity have a marked effect on the color and flavor of fruit, especially of apples. Most European varieties are green or yellow ("pippins" and "codlings") or a dull, unattractive red, and quite tart. American varieties are much more brilliant in color, sweeter, and more richly flavored. A Pennsylvania Stayman so far surpasses an English Cox's Orange Pippin, in appearance and quality, as to make the comparison invidious.

European orchards are much smaller than ours. In Kent County, England, I saw several 50-acre apple orchards, but these are exceptional. The average is nearer five acres than fifty. Fruit growing is more intensive, and more personal than ours. With them, the individual tree is the unit; with us, the acre. American fruit growing is a business enterprise; each orchard usually requires considerable capital and employs many men. European fruit growing is more likely to be a family enterprise, limited in size by the labor capacity of the family. The whole family—father, mother, and children—work long hours in the orchard;

they have an intimate knowledge of the history and capacities of each tree which our growers seldom acquire.

Close Planting. In European orchards the trees are planted very closely together, as judged by American standards, partly because land is scarce and dear. In the older orchards the tops make an almost continuous canopy through which the sunshine—if any—penetrates with difficulty. Usually there are fillers of dwarf trees or intercrops of small fruits, vegetables, or grains. I saw several remarkable combinations in England, as an apple orchard with dwarf apple fillers, between which were currants and gooseberries, and beneath these strawberries, vegetables and cut flowers. Obviously, horse or tractor labor cannot be used much in such orchards; human labor is cheaper, anyhow. European fruit growing still remains essentially an enterprise of human handicraft; machinery, which characterizes American fruit growing, is absent for the most part.

Of varieties there is no end. Most of them are of limited adaptation. Every country or district has its own favorites, mostly local seedlings. Different city markets demand different varieties, those to which they have become accustomed. Since distances are short and there is no necessity for shipping fruit to distant markets, there is no need to limit the plantings to a few "standard sorts", as we do. A "New England Six" would be impossible in old England. As local market fruit growing increases in America, we, too, will grow more varieties.

Very few of the European varieties of apples, peaches, grapes, and the small fruits are known in America; but some of our most popular pears, plums and cherries are European favorites, also; as Bartlett pear, German prune and Montmorency cherry.

Nursery Trees. The European nurseryman is a commercial fruit grower, propagator and expert on varieties and root stocks, rather than a business man and employer of labor. There are no large blocks of one variety. The nursery is a hodge-podge, with different varieties in the same row, and trees trained in different ways, and worked on different stocks. Apple trees are not sold when one year old, but when four to six years old. These old trees can be transplanted more successfully in this humid climate than would be possible here. In fact, large trees may be transplanted readily. I heard of an orchard of 3,000 apple trees in County Kent, England, which were transplanted in 1935, when fourteen years old, with a 6-foot fall of roots, and bore a fair crop in 1936. This man made himself a bearing orchard in one season.

Standard trees are headed in the nursery, not at two feet, but at six to eight feet. Each tree receives individual attention. Such trees sell for more than our growers would pay, sometimes for over a dollar each. These high headed apple trees are destined for the two story fruit growing which has prevailed in Europe, especially in Great Britain, from time immemorial—apples above, grass or cultivated crops beneath. This type of fruit growing is associated with general farming.

In recent years, however, fruit growing in Europe has begun to pass into the hands of fruit specialists, as it has long since in America. A new type of commercial apple orchard is springing up all over Great Britain and in parts of the continent. This consists of trees on semi-

dwarfing rootstocks, planted about 18 feet apart each way. Such trees are headed at about one foot, trained to open centers. They are kept about 12 feet high, and are only a little larger than our peach trees. They are grafted on "clonal" rootstocks, which may be readily propagated vegetatively, by layering, instead of on seedlings, which is the common American practice. It is claimed that such trees are much more uniform in vigor, productiveness and disease resistance than those on seedling roots. Hatton, of the East Malling Fruit Experiment Station, England, has isolated several types of apple root-stocks, of varying degrees of vigor, and adapted for use on different soils, and different varieties.

The British have gone much farther than we have in the study of root systems and their relation to tree behavior. We bury the roots of our trees and forget about them. Some of Hatton's best rootstocks, and others developed by Dr. R. D. Anthony, are now under trial in Pennsylvania. I am convinced that the drift in this country, also, will be toward the use of smaller apple trees propagated on clonal rather than seedling roots, not only because of greater uniformity of orchard performance but also because it is possible to prune, spray and harvest these smaller trees more cheaply and more efficiently than the giant trees that we now grow. There is little if any loss in yield per acre; these semi-standard apple trees, planted 18 feet apart, produce 8 to 10 bushels per tree.

Sod Orchards. As might be expected in this humid and equable climate, most of the bearing orchards are in sod. The grass is either cut for hay or is pastured; rarely is it left as a mulch. This is especially true of the old-time two story fruit growing with high-headed trees. In Germany and Switzerland, apples, plums and cherries almost invariably are in sod, or the orchard is cropped with grains. There the fruit trees seem to be incidental to the cropping; they are scattered irregularly over the land with many vacant areas, from which hay or crops are harvested. Many of the apple trees were grafted in place, as was the practice in the Colonial America.

In many of the modern orchards on dwarfing rootstocks, sod rotations are practiced as in Pennsylvania, the sod being broken every five or six years and the land immediately reseeded. Annual cover crops are not used; they have found, as we have, that sod rotations are the most dependable sources of organic matter. The climate is very favorable to the accumulation of organic matter, hence the supply of nitrogen usually is adequate without adding it as a fertilizer. Potash, not nitrogen, usually is the limiting factor. Applications of phosphorus are rarely necessary.

Dwarf Trained Trees. One of the unique features of European fruit growing, especially of France and Belgium, is the training of dwarf trees in the "fruit garden", as distinct from the orchard. To a French gardener, a fruit tree is plastic material, to be moulded into any form that may please his fancy. Practically all dessert fruit produced on the Continent is grown on dwarf trees trained against the sunny side of walls and buildings or on wires, like our grape-vines. The trees are made to assume innumerable geometrical designs—globes, pyramids,

fans, vases, espalier, cordon, umbrella, and other fanciful shapes. I saw one pear tree trained to resemble a rooster. Each bud must be counted, and each twig trained and tied. A French or Flemish gardener may spend as much time training one dwarf apple tree bearing 30 fruits as an American does in pruning a standard tree bearing 3,000 fruits. The gardener is an artist and an architect, as well as a grower.

Dwarf trees receive intensive cultivation and fertilizing. The product is mainly for home use, but there are some commercial fruit gardens. Near Lyons, France, I saw several fruit gardens of over ten acres each. One man can care for about one acre of trees, from which a gross return of \$1,000 to \$1,500 may be expected. Dwarf trees produce fruit of great beauty and high quality, but few of them. The fruit must sell for a very high price; peaches and pears for 35 to 50 cents each, apples for around 25 cents each. Dwarf trained fruits have no place in American pomology except in the gardens of the rich or of the enthusiastic amateur.

In comparison with these petted and pampered dwarfs, standard trees are often sadly neglected. Most of them are far too bushy to satisfy the best American ideals. Possibly this is because most of the fruit from them is used for cider.

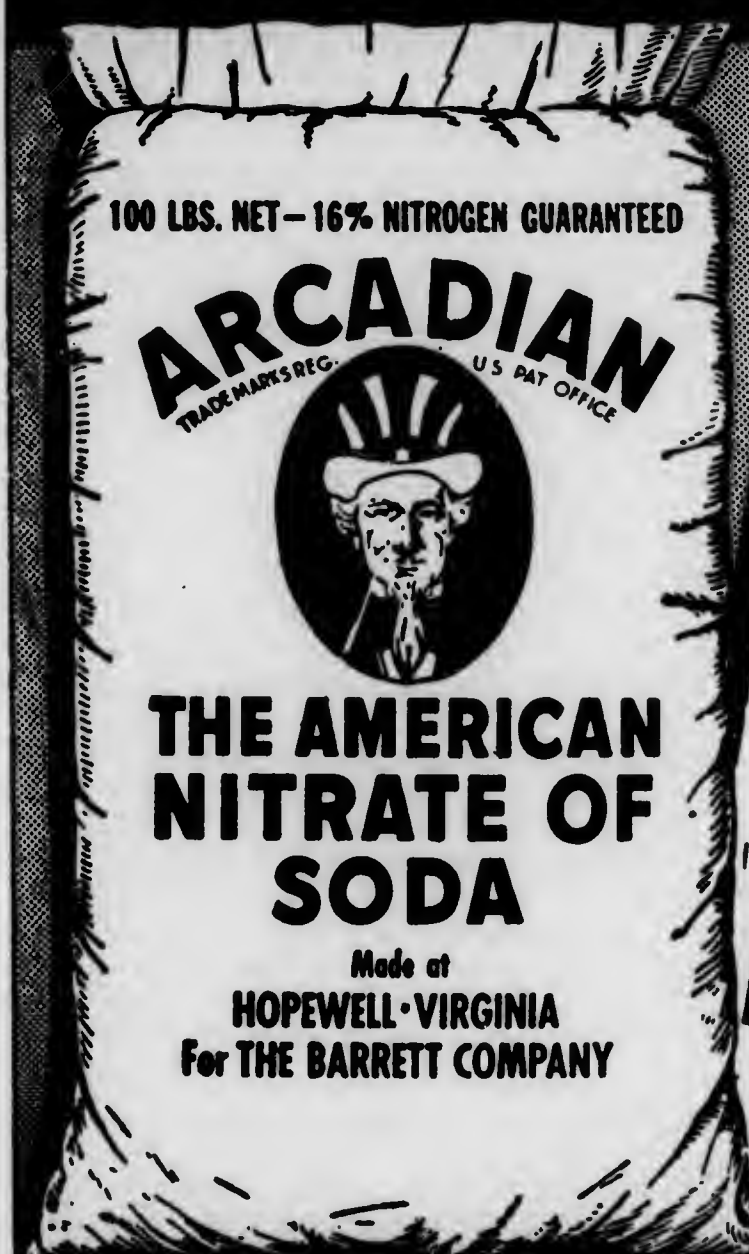
Little Spraying. The most striking deficiency of European fruit growing, as it seems to an American, is the almost universal neglect of spraying. Even in France, which gave birth to modern spraying, at Bordeaux, few fruit trees are sprayed regularly, especially when the fruit is grown for juice. The vineyard is sprayed and dusted quite thoroughly, and the French have an excellent line of vineyard sprayers; but one looks in vain for an orchard power sprayer or even for a good hand pump. In fruit gardens, the back-breaking knapsack pump still is in common use, but usually the fruits are covered with paper sacks soon after setting. This gives them a waxy finish and a delicate coloring.

Some of the modern commercial orchards of England, however, have stationary spray systems equal in efficiency to any in America. There is no room in these closely planted orchards for portable sprayers. The pipes are laid on top of the ground with hose connections every three or four rows. A pressure of 600 pounds is maintained with six leads of hose. The men push a short two-nozzle rod up through the canopy of leaves, which is about ten feet above the ground. Four to six applications a season give protection against the most serious pests, which are scab, red spider, downy mildew, "caterpillar" and codling moth. It made me feel quite at home to hear the growers say, "Codling moth is increasing." They use liquid lime-sulphur, arsenate of lead and nicotine sulphate, chiefly.

A Leisurely Harvest. The harvest season is not as hectic a time as ours. We are obliged to rush from day break to night fall, for our fruit ripens quickly and deteriorates readily. The cool climate of western Europe makes the fruit ripen slowly; the growers can take their time in picking and marketing. Refrigeration is not needed, for fruit is not shipped long distances. Cold storage, also, is seldom used; common storage is the rule.

The packages are quite different from ours and are of all sizes, shapes and materials—they are not standardized by law. Most of the baskets

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are heavy, returnable willow packages, and quite unattractive as compared with our neat gift packages. Baskets of apples are sometimes lined and covered with hay or straw.

Most of the fruit is sold without the aid of middlemen. Every city, town and village has a public market, where producers and buyers meet. The European fruit grower is a salesman as well as a producer.

Fruit to Drink. The great bulk of the fruit crop, however, is consumed in liquid form. The Europeans drink wine, cider, perry and other fermented fruit juices, about as freely as we do water. A Frenchman drinks no water except under dire necessity; an Englishman drinks it only in the form of tea. In Continental Europe, tea and coffee, not wines and ciders, are regarded as harmful, habit-forming stimulants.

Since the ultimate destination of most apples is the cider barrel, there is little incentive to spray to secure perfect fruit. It was so in America until about seventy-five years ago. In Europe, cider is not a by-product, as with us, but a main product—all the crop may be pressed for juice. Other fruit by-products, especially jams, preserves, and marmalades, are used much more freely than in America. They use far less canned and dried fruits than we do; here would be an excellent outlet for American fruits—if the tariff walls were lowered.

Mountain Vineyards. The most unique feature of European fruit growing, other than the dwarf trained trees, is the grape. European vineyards are quite different from those of Pennsylvania; they more nearly resemble the vineyards of California. In France and Germany the grape usually has a short, thick trunk, about twelve inches high and six to ten inches thick; it is self-supporting; there are no wire trellises. From the top of this trunk spring three to five very short canes. Each of these bear three or four shoots on which grapes are produced. Grapes are planted three or four feet apart and the canes are tied up to stakes. Some of the vines are centuries old, gnarled with age, and hoary with moss. The yields per acre are tremendous and the quality is good but most of the fruit is pressed for wine.

The vineyards which clothe the steep gorges of the Rhine and Moselle rivers in Germany are the ultimate in spectacular and laborious fruit growing. Slopes at an angle of forty-five degrees, or more, are terraced and planted. Narrow shelves are cut in the face of the cliff and covered with soil brought up from the lower slopes on the broad backs of German peasants, men and women. Some of these terraces are mere pockets of soil, holding only 15 to 20 vines. The surface of the soil is covered with fragments of rock to prevent erosion, absorb heat and conserve moisture. The labor of many generations has been expended in terracing these cliffs.

Contrasts with America. An American is impressed with the industry and thrift of European fruit growers. They work long hours for a very moderate recompense, and live frugally. American fruit growers, as a class, are more prodigal. We also take bigger risks. Some day America may be forced to practice the economies of Europe.

The taxes of the European fruit grower are far heavier than ours. We are fortunate in not having as large a non-productive population to support—armies, navies, royalty, and aristocracy.

In Europe, fruit growing is a personal relation between the grower and his trees; he is a husbandman and a craftsman. In America, fruit growing is a business as well as an art; success depends fully as much on shrewdness in buying and selling, and in handling labor, as on cultural skill.

My observation was that European fruit growers are not happy and contented as their American brethren. How could they be, when they live in constant dread of "the next war," which always seems to be imminent? More than 10,000,000 young men were killed in the last tragic struggle; most of them came from farm homes. Europe is impoverished today by the loss of her young manhood. She should have our sympathy, and our moral support to help prevent another great war, for every war falls heavily on the farmer, both in blood and monetary loss.

Export Outlook. There would be a market for large quantities of American apples, peaches and canned fruits in Europe if trade relations were normal. I found little encouragement, however, for the hope that better international relations will soon restore the export trade we have lost, and open up new markets. America is rather cordially disliked in Europe. They think we are selfish. They point to our restrictive immigration laws, our quarantine acts which debar the importation of European nursery stock, our high tariff walls which shut out many European products that previously had access to our markets. But Europe is tarred with the same stick. The intense economic nationalism which has sprung up since the great war, as evidenced by embargoes, quotas, tariffs, import license taxes, compensation exports, and other restrictions, have raised the greatest barriers to foreign trade in history.

Our apple exports have dropped from 24,000,000 bushels in 1926 to about 10,000,000 bushels. Yet the American apple industry was built on the prospect of a reasonable foreign trade. Land in apple trees cannot be put into another crop quickly, as it can with wheat. Great Britain, hitherto our chief export outlet for apples, now has preferential trade agreements with her Dominions. The slogans "Buy British" and "Buy Empire" are being highly publicized, and carry great weight. I saw some very indifferent apples from Australia in London labeled "British to the Core."

So it appears that unless positive steps are taken by the United States, under the Reciprocity Trade Agreement Act, to open the channels of trade that now are clogged by barriers of all kinds, we may expect a constantly dwindling export outlet for our apples. We can only hope that the recent proposals of President Roosevelt to discuss reciprocal trade relations and stabilization of currency with certain European powers may point the way to better days.

SOME IMPORTANT FRUIT INSECTS OF 1936

H. E. HODGKISS, State College, Pa.

A survey of insect conditions on fruit trees indicates that the year has been notable in that unexpected situations predominated among insect pests. The Periodical Cicada, Brood X, emerged according to

schedule but there was no other fruit infesting species that caused damages in so extensive an area. Hence the problems of insect suppression were to a large extent local situations rather than state-wide or regional.

The Periodical Cicada occurred chiefly in the counties east of the Allegheny Plateau. Individuals or isolated colonies were located in a few western counties but the heavy infestation of the southern tier counties extended westward as far as and including Somerset County. Throughout the entire area apple or other fruit trees were severely damaged. Many apple growers claimed that the losses were greater than in 1919. Young and old trees were cut badly. However, those which were not of bearing age suffered the most severely. It was not uncommon to observe that entire young plantings were wiped out. In a number of orchards the fruits on cut branches sometimes were shriveled. Some fruit growers claimed that the cutting of terminal branches resulted in a greater sizing of apples back of the cut ends.

Control practices were limited to protecting young trees. Cheese-cloth shrouds were used in most instances. These either enveloped the entire tree above the lowest branches or the tips of terminals were left uncovered. In Cumberland County a fruit grower used cornstalks. He set these up and into the branches. The protection was given to trees that were 5 to 8 years old and was very satisfactory except where the ends of twigs or small limbs extended beyond the protection.

The apple curculio was destructive to apple fruits throughout Eastern Pennsylvania. This is long snouted and closely related to the species that are commonly known as nut curculios. It occurs chiefly in orchards wholly or partly surrounded by woods or where individual hickory, walnut or thorn trees are growing rather close to the orchard. The apple curculio can not be controlled by the usual schedule spraying with lead arsenate on account of its breeding habit. The eggs are inserted into young newly formed apples. The grubs hatch from the eggs and remain in the apple until the new beetle has matured. Many of the infested fruits drop to the ground. Those that remain on the trees become knobbed and deep narrow openings occur at points of original injury. The new brood of beetles often commence to emerge early in July. There is some feeding by these adults on maturing apples but the insects seek winter protection rather early and remain in hibernation until the following spring.

There has been a definite widespread increase in the number of infested orchards during the past five years. If this condition is a criterion for evaluating the problem it is full time to familiarize fruit growers with the special suppression practices that are required. Any fruit grower who has had occasion to fight this pest knows that it can come back strong despite all the efforts that have been expended on control. A complete cleanup and destruction of all early drop apples, the removal of brush in adjacent fence rows, or wild growth in nearby fields, the removal and destruction before the end of June of all apples on the trees that show evidences of curculio injury and the thorough and complete coverage of foliage and young fruits between petal fall and the end of July with the lead arsenate-powdered milk combination spray,

or the usual insecticide-fungicide combination when the spray applications coincide with the regular spraying schedule are necessary practices. In order to have a coverage on the young apples a special spray may be required between the petal fall and first cover sprays.

Another beetle that was destructive over a rather wide area is commonly named the rose beetle. This is not the well-known yellow colored rose chafer. The rose beetle is about the same shape and smaller than the two-spotted ladybird beetle. Its color is a uniform brilliant green. The beetle is not easily recognized at first but if the adults are not seen the peculiar marks left in the wounds or young apples place the miscreant easily. The cuts in the apples appear as if made by mice which have left characteristic tooth marks. The beetles commence feeding on the fruits within a short time after the apples are set and continue until the fruits are quite sizable. The apples may become malformed and in healing the cut surface is covered with thickened corky tissue. This layer cracks as the apple sizes. In some varieties of apples the corky covering breaks off leaving a smooth, russeted surface on the injured area of the malformed apple. Apples even slightly injured are not suitable for the commercial apple pack.

Our information on the life history, habits and control of this insect is somewhat meager. The field observations have indicated that the beetles emerge early and prefer to feed on apples that are not protected with a coating of lead arsenate. They have been observed to eat through the surface where a lead arsenate coating was not complete. It would appear as if the best control practice is to cover the young apples with a lead arsenate-spreader combination spray in between the petal fall spray and the first cover spray and to maintain a coverage of lead arsenate until the beetles have disappeared from the trees. The rose beetle is so capable of causing extensive damage that growers having trouble with the insect should aim to keep it in subjection.

A discussion of apple pests would not be complete if the acarina or mites were omitted. The European red spider has become a perennial invader of our orchards. While it occurs on stone fruits as well as the pome fruits we are particularly concerned with the damage to apple trees. This has become more evident as growers have become accustomed to use newer sprays or to a reduction in the dilution of lime sulphur that has been recommended in order to avoid burning of the foliage. The aim of the initial control practice is to destroy the eggs. A spraying oil is the most satisfactory insecticide. Combinations of creosote oils and oil emulsions have not worked out as well as the oil sprays applied uncombined. Spraying oils with lime sulphur solution used as delayed dormant sprays are of doubtful utility. A few growers have applied summer spraying oils on trees in full foliage with disastrous results. Yet it is probable that the solution of the red spider problem is to apply a summer spraying oil as a supplement to the regular dormant spraying oil which is applied against the eggs.

The reason for the apparent contradiction in statements is not difficult to explain. It is not easy to arrange for a program of spraying preceding the application of a summer oil spray that will permit the sum-

mer oil to be used with a reasonable degree of safeness to the foliage. It is recognized that improper dilutions of summer spraying oils will cause severe foliage and fruit burning in the presence of the usual coverage of lime sulphur solution. Where foliage burning has occurred the oil has been used within a short interval of time after lime sulphur sprays have been discontinued.

Last year the excessive breeding of the mites resulted in a severe bronzing of apple foliage throughout the southeastern counties. In order to demonstrate that summer oil sprays could be used with a reasonable freedom from burning, comparisons were made in a Chester County orchard in which a summer oil was applied at intervals of 2, 3, 4, 5, and 6 weeks after the lime sulphur was omitted. The oil was diluted at the rate of 5 quarts in 100 gallons of spray at each application. The comparisons were outstanding. Severe burning of the foliage occurred on Rome and Stayman apple trees where the oil was used two weeks after the lime sulphur was applied. A small amount of foliage injury showed where the oil was used three weeks after lime sulphur. Where the oil spray was put on four, five and six weeks after the lime sulphur was discontinued no injury was noticeable.

Two comparisons of copper sprays were included in the test. Where a 2-6-100 Bordeaux mixture was mixed with the oil and applied three weeks after lime sulphur foliage injury occurred. In another block of Stayman apples a copper spray was applied 10 days after lime sulphur and this was followed in one week by a spray of summer oil. No foliage injury occurred.

The red spider control was satisfactory and the discolored foliage appeared to regain its vigor. The trees matured a good crop of apples.

The Peach leaf mite, *Phyllocoptes cornutus* Banks is often named the silver leaf mite on account of the deep lead coloration of leaves that are infested by the acarids. The mites are spindle shaped creatures approximately 1-125 of an inch in length. Unlike many other eriophyids this species does not cause any noticeable protuberances on the leaf surfaces. The ultimate deep leaden color of the foliage comes on so gradually that few fruit growers recognize that the normal coloration has changed.

The condition was recognized in 1919 when it was observed throughout the southeastern peach growing counties. Since then I have seen the mites and their work each year. The mite infestation has never been so small that the silver tone has been absent from the foliage. This winter peach buds are alive with the hibernating eriophyids.

The plant mites hibernate under bud scales and can be controlled by spring applications of either lime sulphur or a spraying oil made just before green begins to show in the buds. It may become advisable to destroy these pests. In any case the condition is one that is well worth a thorough investigation.

Fruit growers who have banded apple trees as a supplementary practice in fighting heavy codling moth infestations have inquired from time to time if there was any need for continuing the practice once the

infestation was under control. In order to obtain some information on the relative merits of the scraping and banding operations some data taken in Adams County orchards were arranged according to infestation and banding records. These trees were of large size and most of the trunks were from 35 to 38 inches in circumference. In one block the trunks had a girth of 45 inches. The regular spraying program was applied completely in each orchard.

In orchard Number 1, which had been scraped and banded for one year, 10 trees were examined and 1,412 larvae were taken from beneath the bands. There were 1,315 dead caterpillars and 97 live ones. Orchard Number 2 was unscraped and had been banded only one year. Here more living larvae were found beneath the loose bark above and below the bands than there were under the bands. On five trees only 124 caterpillars were collected beneath the bands, of which 112 were dead. A comparison of orchard Number 1 scraped and banded for one year with a second orchard which had been scraped and banded for two years showed large reductions in codling moth population by the supplementary practice. In the first case 1,412 larvae were taken under 10 bands. In the second block 353 caterpillars were collected from five bands. A third orchard scraped and banded during 1934, 1935 and 1936 had only 41 worms under five bands. Of 1,806 caterpillars collected 1,600 were dead.

The value of a definite program combining scraping, insecticidal bands and a complete schedule of spraying is indicated by the following four year comparisons of conditions in an Adams County orchard before and after scraping and banding.

TABLE 1. SCRAPING AND BANDING APPLE TREES IN ADAMS COUNTY

Year	Condition	No. of Sprays	Per Cent of Wormy Apples
1933	Not scraped or banded	5	36.0
1934	Scraped and treated bands	7	8.0
1935	Scraped and treated bands	7	6.0
1936	Scraped and treated bands	7	1.4

In Cumberland County an orchard record shows that there was a very small reduction in worminess of fruit during two years when no scraping and banding was done, but there was a decided improvement after the trees were scraped and banded.

TABLE 2. SCRAPING AND BANDING APPLE TREES IN CUMBERLAND COUNTY

Year	Condition	No. of Sprays	Per Cent of Wormy Apples
1933	Not scraped or banded	9	44.2
1934	Scraped and treated bands	9	36.8
1935	Scraped and treated bands	9	5.0
1936	Scraped and treated bands	9	.5

Another example is of three orchards in Franklin County where a similar plan has been in operation since 1933.

TABLE 3. SUPPLEMENTS FOR SPRAYS IN CODLING MOTH CONTROL
FRANKLIN COUNTY

Year	Condition	Cover Sprays No.	Per Cent Codling Moth		
			Orch. No. 1	Orch. No. 2	Orch. No. 3
1933	Unscraped burlap bands	6	52.3	18.6	15.4
1934	Scraped and treated bands	7	14.8	13.6	6.5
1935	Scraped and treated bands	7	6.2	3.9	1.3
1936	Scraped and treated bands	7	2.4	.0	.4

It would appear from these data that in heavily infested orchards the additional cost of the supplementary practice is sufficiently covered by the higher value of the crops as well as the usefulness in reducing the codling moth population. It should be continued for several years, at least.

The San Jose scale and the apple maggot deserve more than passing consideration. With the regulations prescribed against these insects by countries importing apples extra efforts are required to prevent even minor infestations on fruits. This is of particular importance in counties where the export trade has not factored to any extent up to the last two or three years. There is more need now than ever for fruit growers to use the July cover spray as a preventive of maggot infestation. In those orchards where the San Jose scale is a menace orchardists would do well to avoid the hurry and confusion that results when the orchards are entirely sprayed during the delayed dormant period and not to become involved in using untried materials. Suitable substitutes have not yet been discovered for the standard spray materials on apple trees despite all the arguments that are used to promote unsafe and unsound recommendations.

A word about the use of insecticides, spraying machinery and cleaning the fruits. There has been a tendency to use machinery and tools that are not sufficient for the job. Spraying for insects must be done thoroughly. Not one scale insect or egg should be missed. Leaf or bud coverage even at the expense of minor injury must be complete and drenching. Misty sprays have no room in our scheme. You can not drive the spray well enough through the foliage with any type of nozzle yet devised. It is a generally accepted fact that under surface coverage of the foliage must be accomplished and this means inside work. The tops must be drenched from both the outside and the inside. The tools by which this can be accomplished are of value only as they serve the purpose of the individual. The ultimate object is to get the job done in a way that will give a complete coverage of foliage and fruits in the shortest time possible with the outfit available. If the outfits are not able to carry the load the answer to control is to discard these machines for those which will do the job. There is this one standard of comparison. The machine or part used must be able to do the job in a minimum of time; it must not do just a job pleasing to the eye; the job must be done correctly. By correctly I mean the most economical way to get complete control of the insect infestation and not necessarily the way that is most pleasing because the superficial contrasts are the most striking.

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*Reg. U. S. Pat. Off. and Principal Foreign Countries

Feeds the Tree Evenly Throughout Growing Season

Another matter that is of essential importance to all fruit growers is the need for removing excess spray residues from apples as they are being prepared for market. During the period that the strict imposition of tolerance specifications of lead and arsenic was largely conducted in the principal export counties there was little fear from the small grower that their apples would be checked on account of excess residues. With these specifications affecting the smaller orchardist as well as the larger one, there is need for the grower to watch more closely the residue conditions on the fruits. Apple washing does not require an expensive outfit for the man who has a few apples nor even a man who has a large annual crop. These conditions can be met and should be met if it is the purpose of the fruit growing industry to maintain the high quality of Pennsylvania grown apples for which it has obtained a justly deserved reputation.

RESEARCH WORK WITH APPLE INSECTS IN 1936

H. N. WORTHLEY, State College, Pa.

Today I propose to review briefly the results obtained by the Agricultural Experiment Station during the past season in studies dealing with apple insects. The investigations have included materials for use in the dormant and delayed dormant sprays, the better use of insecticides, chemically treated bands, and traps for codling moth control, and a preliminary study of the rose leaf-beetle, *Nodonota puncticollis* Say.

Dormant and Delayed Dormant Sprays

As shown in Figure 1, the experiments of 1936 revealed again that the dormant application of coal tar oil emulsion gives superior results in the control of apple aphids. The commercial emulsions which contain 37 per cent tar oil and 46 per cent lubricating oil are used at the rate of 6.5 gallons per hundred. Thus diluted, the spray mixture contains 2.4 per cent tar oil (for rosy aphis) and 3.0 per cent lubricating oil (for San Jose scale). Tar oil alone is known to be of low value against winter eggs of the European red mite. Because of small populations of this pest in the test blocks, our experiments to date have failed to show whether or not there is enough lubricating oil in the above mixture to give satisfactory mite control.

In 1936 the "silver bud" application of 3 per cent lubricating oil plus 0.5 per cent cresylic acid (treatment 2) gave results nearly equal to the tar oil. In our tests this mixture has done no damage to the trees, but reports from other States tell of severe injury to the opening buds, and it is evident that this combination cannot be recommended. This is unfortunate, for it costs about 80 cents less per hundred gallons than treatment 1, and \$1.00 less than the "standard" delayed dormant mixture of lime sulphur, lead arsenate, and nicotine sulphate (treatment 3). This latter treatment has given variable results in aphid control. However, the mixture constitutes a single early season spray, and for this reason it is still useful except where red mite is a problem or where

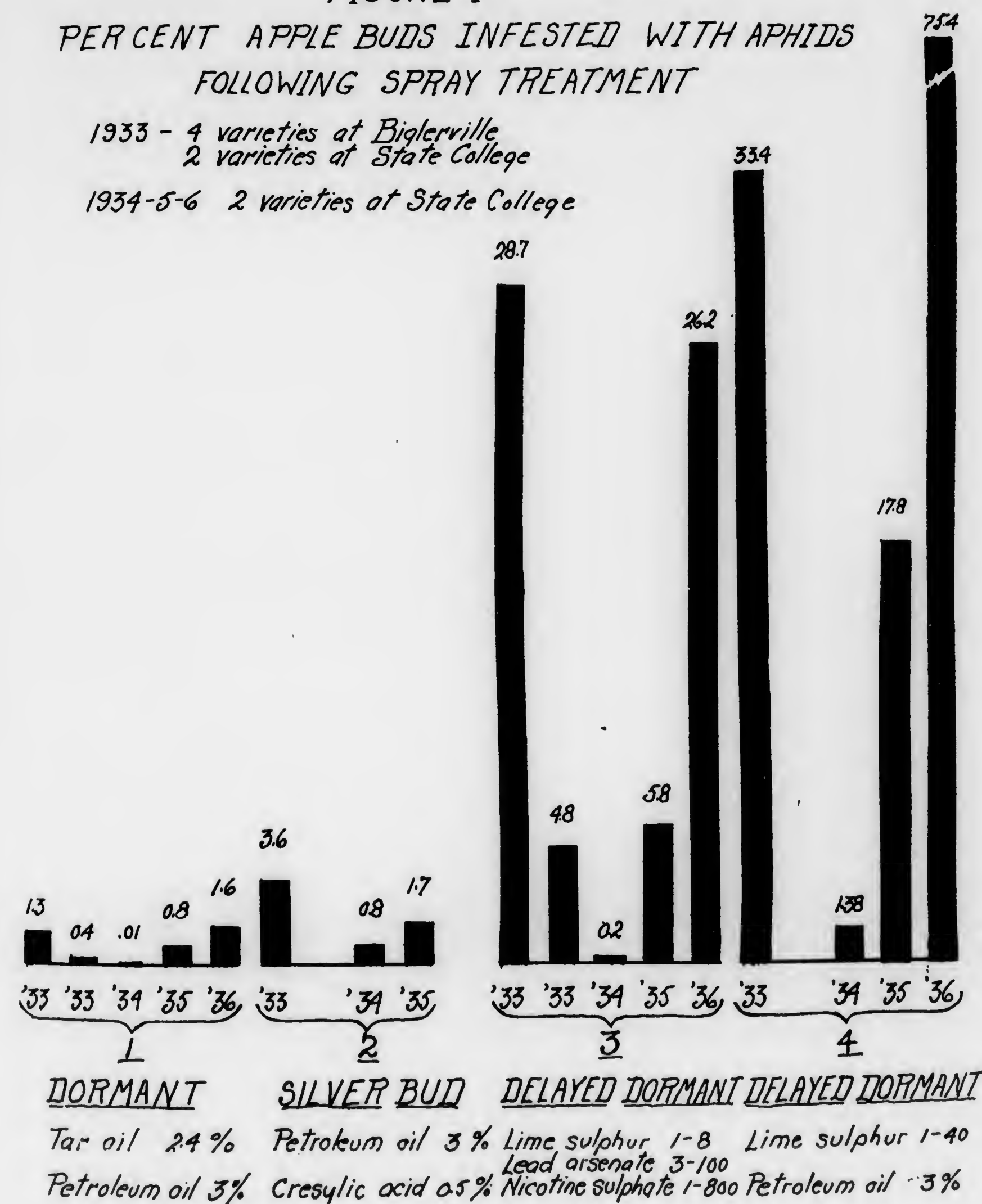
plantings are too large to be sprayed completely during the delayed dormant period.

The delayed dormant application of lubricating oil emulsion and summer strength lime sulphur (treatment 4) is about \$1.10 per hundred gallons cheaper than treatment 3, and it has been included in the studies for that reason. It has given consistently poorer results in aphid control

FIGURE 1
PERCENT APPLE BUDS INFESTED WITH APHIDS
FOLLOWING SPRAY TREATMENT

1933 - 4 varieties at Biglerville
2 varieties at State College

1934-5-6 2 varieties at State College



than the other mixtures investigated. This result was very evident on the fruit in 1933, which was the last year of heavy rosy aphid attack. Growers using this mixture during the past two or three years, when rosy aphid damage has been slight, have been satisfied with results. The experimental evidence, however, points to the possibility of disappointment if this spray mixture is used in a bad aphid year.

TABLE 1. CODLING MOTH CONTROL, HEACOCK ORCHARD
Biglerville, Pa. 1936

Treatment (Am'ts per 100 gals.)	Var.	Dropped and picked fruit			Gr.-lb. at harvest	
		Clean %	Wms. per 100 Apples	Spray burn %	Pb	As ₂ O ₃
1. L. arsen. 3 lbs., fish oil 1 qt. May 26, June 9, June 22. Flot. sul. 5 lbs.* Black Leaf 40 3/4 pint, BS Fixator 5 lbs., July 18, July 29	G	84.0	7.6	13.0	.041	.020
	R	94.7	2.0	8.2	.019	.005
2. L. arsen. 3 lbs., fish oil 1 qt. May 26. Flot. sul. 5 lbs.* Black Leaf 155-X 5 lbs., June 9, June 22, July 18, July 29.	G	76.2	24.0	12.7	.010	.003
	R	90.0	8.5	2.3	.004	.001
3. L. arsen. 3 lbs., fish oil 1 qt. May 26, June 9, June 22. Flot. sul. 5 lbs.* Black Leaf 155-X 5 lbs., June 9, June 22, July 18, July 29.	G	75.3	20.5	18.2	.014	.007
	R	91.6	4.5	3.3	.015	.007
4. L. arsen. 3 lbs., fish oil 1 qt. May 26. 1 qt. May 26. Flot. sul. 5 lbs.* Black Leaf 155-Z 8 lbs., June 9, June 22, July 18, July 29.	G	75.3	19.2	9.2	.008	.003
	R	93.7	6.1	2.2	.008	.001
5. L. arsen. 3 lbs., fish oil 1 qt. May 26. Cuposil 2 lbs.* Black Leaf 155-O 3 lbs., June 9 Black Leaf 155-O 1.5 lbs., Orthol-K RM 2 qts. June 22, July 18, July 29.	G	74.6	26.2	52.2	.012	.004
	R	93.2	5.5	2.1	.007	.002
6. Check— No treatment	G	45.0	84.3	—	—	—
	R	83.9	21.6	—	—	—
Least significant difference	G	5.0	7.4	12.6	—	—
	R	5.0	4.4	3.6	—	—

*Fungicides applied only on May 26 and June 9.

Insecticides for Codling Moth Control

Table 1 gives schedules and materials used, and results obtained, of a heavily infested block of Grimes Golden and a lightly infested block of Rome Beauty in the orchard of O. J. Heacock at Biglerville in Adams County. The tests involved "fixed nicotine" substitutes for lead arsenate, several forms of which are being developed by the Tobacco By-Products and Chemical Corporation. In 1935 one of these materials, used with summer oil emulsion in 5 cover sprays following 3 cover sprays of lead arsenate, gave results in worm control nearly equal to lead arsenate in 5 cover sprays. See Pa. Agr. Exp. Station Bulletin 324.

In 1936 all materials were tested in a schedule of 5 cover sprays only to investigate the possibility that control might be obtained without extra applications. On July 14 fruit counts showed the treatments to be about equally effective, with the exception of treatment 3 which already showed poor results. By harvest time, however, as shown in Table 1, worm control was best in treatment 1, where 3 sprays of lead arsenate plus fish oil were followed by 2 sprays of nicotine sulphate plus BS Fixator. This last named material is a dry mixture of bentonite clay with substances that cause it to wet and disperse in the spray tank. A chemical union of the nicotine and bentonite takes place, and the resulting product has both larvicidal and ovicidal properties.

It is quite apparent that the 3 sprays of lead arsenate in treatment 1 produced a poison coating that retained its effectiveness longer than the coatings produced by the various experimental nictines used in treatments 2, 4, and 5. In treatment 3, where additional benefit was sought by adding nicotine to lead arsenate in the second and third cover sprays, the lead arsenate appeared to do little good. Apparently the wetting agent in the nicotine formula caused too much run-off, so that the protective coating produced, while nearly adequate on the lightly infested Rome Beauty, was insufficient on the more heavily infested Grimes Golden.

A second series of spraying tests was conducted in a heavily infested block of Jonathan in the orchard of E. H. Sachs at Biglerville. The results are given in Table 2. Fruit counts on July 13 showed only slight differences in worminess in treatments 1 to 3, where lead arsenate was employed with different stickers. In plot 4 Spreadol (which, like Nopco, is a neutral potash fish oil soap) was supposed to wet the elemental sulphur employed in the first two cover sprays as the fungicide. This it largely failed to do, and the resulting spray mixture gave poor coverage, so that by July 13 this treatment already showed poor results.

The fish oil soaps proved to be quite inferior to raw menhaden fish oil as stickers for lead arsenate. Compare treatments 1, 2 and 3 in Table 2. As in former years the fish oil, which may be added to lead arsenate except when lime sulphur must be used, greatly aided the retention of poison on the fruit and increased the degree of control without producing residues difficult to remove at harvest.

The results with treatments 5 to 8 are omitted from Table 2. In these plots various forms of nicotine were tested, with and without copper fungicides and oil sprays. The final results were inferior to those with

treatment 1, and revealed nothing of present practical value in codling moth control. They did show, however, that lime must be added to copper fungicides on tender skinned varieties like Jonathan to avoid copper russet. This fact has a bearing on codling moth control, for lime reduces the effectiveness of lead arsenate and also of the "fixed nicotine" compounds.

TABLE 2. CODLING MOTH CONTROL, SACHS ORCHARD
Biglerville, Pa., 1936

Materials	Spray Dates			Clean %	Dropped and picked fruit		Gr.-lb. at harvest Pb As ² O ³		
	Amt. per 100 gals.				Wms. per 100 Apples	Spray Injured			
	May 26 June 10	June 20 July 2	July 29			fruit %			leaves %
1. L. arsen.—lbs.....	3.0	3.0	84.0	6.5	6.4	67.8	.041	.020	
Flot. sul.—lbs.....	5.0	...							
Fish oil—pts.....	1.0	1.0							
2. L. arsen.—lbs.....	3.0	3.0							
Flot. sul.—lbs.....	5.0	...	76.6	13.3	5.1	67.1	.022	.013	
Spreadol—pts.....	1.0	1.0							
3. L. arsen.—lbs.....	3.0	3.0							
Flot. sul.—lbs.....	5.0	...	77.0	14.4	5.3	69.5	.025	.012	
Nopco—pts.....	1.0	1.0							
4. L. arsen.—lbs.....	3.0	3.0							
325—mesh sul.....	6.0	...	75.4	13.7	6.2	72.3	.018	.003	
Spreadol—pts.....	1.0	1.0							
9. Phenothiaz.—lbs.....	4.0	4.0							
Flot. sul.—lbs.....	5.0	...	70.3	29.8	5.0	11.6	.004	tr	
Wheat flour—lbs.....	...	4.0							
10. Phenothiaz.—lbs.....	4.0	4.0							
Flot. sul.—lbs.....	5.0	...	73.3	29.6	7.4	10.9	.003	tr	
Spreadol—pts.....	1.0	1.0							
Least significant diff...			4.7	6.0	3.6	2.5			
Unsprayed checks.....			50.1	63.3		13.9	..		

Nopco omitted in 5th cover.

A new organic insecticide, Phenothiazine, was tested in all cover sprays in treatments 9 and 10. The material is practically non-poisonous to higher animals, but in laboratory tests and field experiments in the Pacific northwest it has proved to be very toxic to codling moth larvae. Under eastern climatic conditions, however, it gave poor control in 1936 wherever it was tried. As may be seen in Table 2 it gave very poor control but far less foliage injury than lead arsenate. It is to be hoped that the chemists can do something to improve this product.

The spray injury figures given in table 2 will be discussed later in this program by Dr. H. W. Thurston. It may be mentioned here, however, that this block of trees suffered heavily in 1936 from the egg-laying

activities of Brood X of the Periodical Cicada. Unsprayed trees showed over 10 per cent injured foliage due to the extensive riddling of twigs by the female cicadas, and this weakening of the trees is thought to have increased the amount of spray injury.

The experiments of 1936 show that lead arsenate with fish oil in all cover sprays, followed by fruit washing, remains the most satisfactory and economical method of reducing large populations of the codling moth under conditions in south-central Pennsylvania. If washing cannot be practised, the use of lead arsenate should be abandoned after the first cover spray on early and mid-season varieties, and after the second cover spray on late varieties. To protect the crop under these conditions subsequent first brood sprays of nicotine should be spaced at intervals not greater than 10 days, and second brood sprays should be applied whenever fresh worm entries are seen. For Pennsylvania conditions, where residues of sulphur may interfere with the application of summer oil emulsions, nicotine sulphate $\frac{3}{4}$ pint with BS Fixator 5 pounds per hundred gallons seems to offer the most promise of any of the substitutes for lead arsenate.

Chemically Treated Bands

Methods for the home preparation of chemically treated bands were published in Pa. Agr. Exp. Station Bulletin 330. There it was stated that under Pennsylvania conditions cold dipped bands should contain 6.5 pounds of chemical coating per 250-foot roll of 2-inch band. To produce this weight in one dipping process it was recommended that the bands should not be completely immersed in the dipping mixture, but dipped to $\frac{3}{4}$ width from each side. Additional tests were made in 1936 to check this point. Table 3 gives the results, which not only support this statement but show that when bands must be re-dipped a wasteful amount of the chemical mixture may remain in the bands.

Tests with Bait and Light to Trap Codling Moths

Many of you are familiar with the use of bait traps to estimate codling moth abundance and help in the timing of spray applications. No. 6 in Table 4 gives the catches with this type of trap in 1936. In the experimental setup two of these traps were compared with two each of 5 other

TABLE 3. TESTS ON TWO INCH BAND, BREAM ORCHARD
Biglerville, Pa., 1936

Dipped in Cod-Ban 1.5 lbs. Gasoline 1 pint	Chemical load per 250 ft.	Moth emerg. %	%Control (x-y) 100 x	% Control of larvae
Complete immersion for 30 seconds.				
Treated once	5.1 lbs.	1.3	91.7	56.8
Treated twice	13.7 lbs.	0.0	100.0	72.7
Dipped to $\frac{3}{4}$ width from each side.				
Treated once	7.6 lbs.	0.12	98.8	71.9
Treated twice	15.6 lbs.	0.19	98.4	89.6

types that employed bait, light, or a combination of both. The traps were hung two trees apart in a rough circle in an unsprayed orchard, and they were examined and moved forward to the next tree each day during the season.

TABLE 4. TESTS OF CODLING MOTH TRAPS
State College, Pa., 1936

Type of trap	Catch of codling moths June 6-Sept. 9, 1936			Per cent of Grand Total Females (666)
	Total	Female	% Female	
1. Electricide.....	212	95	44.8	14.3
2. Trapping shade painted black.....	198	89	44.9	13.4
3. Trapping shade painted black only on top and bottom.....	306	86	28.1	12.9
4. Trapping shade not painted.....	120	41	34.2	6.1
5. 12" diam. bait pan with molasses- water 1-10, under reflector.....	663	310	46.8	46.5
5. 6" diam. bait pail with molasses- water 1-10, not lighted.....	57	45	78.9	6.8
Grand Total.....	1556	666	42.8	100.0

All but No. 6 lighted by 75-watt inside frosted Mazda lamp.

The idea that a large proportion of the moths might be trapped out of an orchard, and so allow a reduction in the number of codling moth sprays, has appealed to many people. There is experimental evidence to indicate that this may eventually be possible. So far, however, tests in commercial orchards in other States have utilized only the relatively expensive electrocuting type of light trap (No. 1, Table 4). Practical application of the method depends upon finding an equally effective trap that can be installed at far less cost. Our Tests, which have run over a three-year period, are worth reporting at this time only because they show some progress in that direction. No. 5 in Table 4, which comprised a 12-inch cake tin containing bait suspended beneath a 75-watt bulb in a metal reflector caught 7 times more female moths than the ordinary bait pail (No. 6), and over 3 times more than the electrocuting trap (No. 1). The extent of its superiority over the latter is not clear, however, for many electrocuted moths are burned beyond recognition. A local tinsmith made these traps for \$1.50 apiece, while the electrocuting type (Folmer Electricide Corporation, Rochester, N. Y.) costs at least \$15.00.

The trapping shade (Nos. 2, 3, 4) was a patented glass light globe perforated to allow the entrance of insects. It is manufactured by R. E. and S. A. Wentzell of Greensburg, Pa., and in quantity production it will probably sell at \$1.00 or less. Darkened so that light was emitted only through the entrance slots (No. 2) it caught almost as many female codling moths as were recovered from the electrocuting trap, and relatively few other insects. These globes will soon be manufactured with a metal base, and means of increasing their effectiveness will be sought by placing attractants in this base to be slowly evolved through the slots.

Their use will have certain advantages over traps containing bait or unshaded light. Fewer beneficial insects will be destroyed, and less frequent inspection will be necessary. With all these devices, however, further perfection through small-scale testing should precede the study of orchard installations for codling moth control.

The Rose Leaf-Beetle

This is a small, rather stout insect, about $\frac{1}{8}$ inch long, that belongs to the leaf-beetle family Chrysomelidae. It may be readily recognized by its shining, metallic bronze-green color. For a number of years this beetle has attracted attention as an apple pest in Adams County and some other localities in the State. It makes shallow excavations by chewing through the skin of the fruits, and this damage occurs from late May until about July 1. Most of the injured apples drop. In 1936 the Experiment Station found it possible to assign Mr. Merrill Wood to this problem, and the following statements are based largely on his report of preliminary investigations.

This beetle has been known since 1826, but it was first noted to be injurious in 1868, when it was caught feeding on plums. Since then it has been found in the adult stage on a wide range of food plants, including the tree fruits, brambles, grapes, strawberries, roses (wild and cultivated), peony, red clover, corn, alder, locust, willow, sumac, dogwood, and Japanese chestnut. The larvae are doubtless root-feeders, but they have not yet been reared, and their host plants are still unknown.

In 1936 fruit counts were made in 74 blocks of trees in 47 Adams County orchards, and infestations were found in scattered blocks from the Maryland line to Cumberland County. The amount of damage was extremely variable, and in the worst infested orchard it ran from 1 per cent to 54 per cent injured fruit in different blocks of trees. The notes taken indicate that damage is more severe on the outside lower branches than in the tops of the trees, and that fruit inside the lower foliage walls is the least injured. There was no correlation between beetle abundance and the presence in the vicinity of suspected breeding plants such as rose, red clover, and sweet clover. Infestations were generally worse in uncultivated, weedy orchards (a fact reported by J. R. Stear in 1920) and in orchards either unsprayed or poorly protected than in blocks where it was evident that spraying had been thorough. Feeding was well distributed over the surface of unsprayed apples, but on sprayed apples was concentrated on those portions of the surface that retained the least spray material. Injury was most common in "doubles" or clusters of unthinned fruit.

In the laboratory Dr. S. W. Frost confined beetles with sprayed and unsprayed apples in bottles, and the results suggested that a good coating of lead arsenate will either kill or repel the beetles. In the field the beetles were first seen on apple on May 25. They were most abundant during the first two weeks of June, and disappeared from apple during the first week in July. They were found on the blossoms of red clover

until July 14, and on wild roses until July 23. Dissections of the females up to July 1 showed only a small proportion of mature eggs, indicating that egg-laying occurs during the later feeding period on herbaceous plants.

Further study of this beetle is planned, with emphasis on control by spraying, seasonal occurrence of the beetles, and the determination of the plants on which eggs are laid and the larvae feed. For the present the best suggestions for growers who have experienced losses due to beetle attack is to make sure of good coverage with lead arsenate, 3 pounds per hundred gallons, in the first cover spray, and to maintain this coverage during June.

SPRAY MATERIALS IN RELATION TO SPRAY INJURY*

H. W. THURSTON, JR., State College, Pa.

It is obvious to all of us that the ideal fungicide for the spraying of apples is not yet at hand. Such a fungicide should be toxic to pathogenic fungi, and at the same time non-injurious to the apple tree. These are the two outstanding properties desired, but in addition to these, we demand a fungicide that is cheap and convenient to handle, one that is not poisonous to men or animals, that will cover easily and stick well, that will not build up toxic residues in the soil and one that is compatible with stomach and contact insecticides. Our present standard spray formulas have all these properties in considerable degree, and yet fall short of the ideal very largely because of the too great amount of injury which they produce under certain conditions or upon certain apple varieties. It is this matter of spray injury that I wish to consider with you today.

Our two great groups of fungicides, the sulphurs and the coppers, are both injurious under certain conditions. Much as we regret to admit it, it seems as if it must be so, of necessity. The mechanism by which a fungicide kills the spores of a parasitic fungus is the same as that by which it produces injury to the foliage or fruit of the apple tree. The very properties in a fungicide that are the basis for its high fungicidal efficiency seems to be the same properties that are also responsible for its injurious effects. The choice of a fungicide and the building of a spray schedule must involve, therefore, a balance between fungicidal efficiency on the one hand, and spray injury on the other. Thus it often appears that a gain in either of these objectives is accompanied by a corresponding loss on the other side of the balance.

To determine what a fungicide will do, it must be tested in the field. Such tests should be made on varieties susceptible to fungous disease for the sake of determining fungicidal efficiency, and they should also be made on varieties susceptible to injury for the sake of determining the safety factor. Field tests must be repeated two or more years to determine the effects of seasonal variations, which are beyond the

*A talk based on this data was also delivered to the Maryland Fruit Growers Association on Jan. 6, 1937.

control of the experimenter. Before reporting on the detailed results of some of these tests as they have been conducted in Pennsylvania, perhaps I should emphasize the complicated nature of what we call spray injury.

Sulphur sprays frequently cause a fruit russet. This may be aggravated early in the season by late spring freezes and unseasonable cold weather. It may also be aggravated by hot weather later in the season, as was the case this past year. Foliage injury appears as brown dead spots, as yellow leaves and as early defoliation. Copper may also cause a fruit russet and foliage injury, usually rather distinct from sulphur injury. Injury from lead arsenate or calcium arsenate adds a further complicating factor. In any test of materials it is desirable to separate these various factors as far as possible. The aim of field tests should be to furnish a detailed analysis of the behavior of the better fungicides—to learn just what can be expected from each one in the way of disease control, to learn what type and how much injury may be expected and under what conditions this injury is most likely to appear. It is only from such an analysis that we will be able to synthesize, or put together again, a more ideal spray schedule. Such a schedule, as I see it, does not necessarily use one fungicide throughout the season but may call for two or three different fungicides at different times, depending upon the season. The ideal schedule is no longer a fixed and definite thing, no longer the same for everyone or the same for all varieties of apples, or even the same in successive years. I have no such ideal schedule to propose. I have only the results from some field tests which I hope make some contribution to the type of analysis I have mentioned, and in that way perhaps contribute also to a firmer foundation for the future.

CHART No. 1. This chart shows fruit injury on the same tree, in the same orchard, sprayed with same sprays in two successive years. It provides a good example of the combined effect of seasonal conditions and sulphur sprays in producing fruit russet on a variety susceptible to this type of injury. In 1935 the injury was the result of the combination of sulphur with a late spring cold snap. Of the three sulphur plots comparable at this time (pre pink and pink) the one receiving dilute liquid lime sulphur (Plot No. 2) was the only one that significantly reduced the injury. That this injury was not due to the cold weather alone is shown by the lack of such injury on the unsprayed check trees. That the injury was not appreciably increased by the later sprays is indicated by the very small difference between Plot 1 and those plots which received mild or substitute materials in the later applications. 1936, however, tells a different story. In this year the fruit russet was brought about by sulphur in combination with the unusual July heat. Plots 6, 7, and 8 which received no sulphur after petal fall, escaped this injury almost entirely, while Plot No. 4 which received flotation sulphur in the petal fall and cover sprays is significantly the best of the sulphur plots. The season of 1936 was especially favorable in bringing out and emphasizing the difference between sulphur sprays with regard to injury.

STAYMAN-STATE COLLEGE-1936

Treatment of Plots

- | | |
|------------------------|-------------------------------------|
| 1. Lime Sulphur | Standard |
| 2. " " | 1-75 |
| 3. " " | 1-100 + 4# Catalytic |
| Pre-Bloom | Petal Fall + 3 Covers |
| 4. L.S.-Standard | Flotation 5#-100 |
| 5. " " | Dry L.S. 4#-100 |
| Pre-Bloom + Petal Fall | 3 Cover Sprays |
| 6. L.S.-Standard | Bordeaux 2-6-100 |
| 7. " " | 4# Cop. Phos, 8# Lime, 4# Bentonite |
| 8. " " | 2# Coposil, 3# Lime |
| 9. Check - No Spray | No Spray |

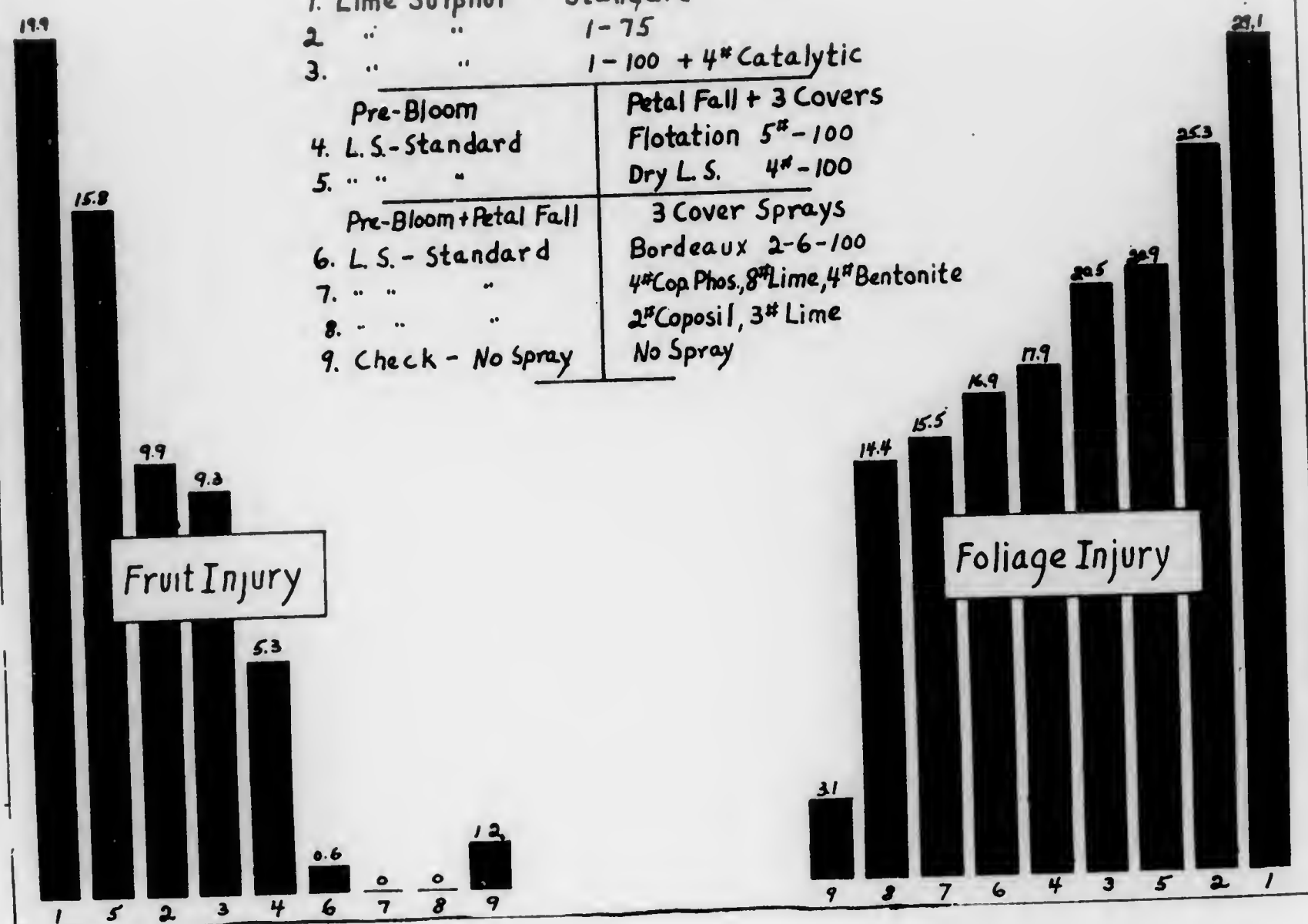


CHART No. 1

Comparison of Fruit Russet on Stayman Winesap at State College, Pa., 1935 & 1936. Figures at top of columns indicate percent of fruit russet. Figures at base of columns are plot numbers corresponding to treatments as indicated.

CHART No. 2. This is a further comparison of the same series of sprays as shown in Chart No. 1, but permits for 1936 a comparison between fruit injury and foliage injury. The figures on foliage injury were arrived at by counting the leaves on 25 terminals chosen at random for each tree. Records were kept of leaves which had dropped as indicated by leaf scars, of those which showed blotch or marginal burning and of those which had turned yellow. The percentages here presented represent the sum of these injuries and the average of four replicates for each treatment. It will be noticed that the differences between treatments are not so pronounced on the leaves as they are on the fruit, and yet the four best materials appear in the same order. The three plots receiving copper compounds in the cover sprays show the least injury to both fruit and foliage, and Plot No. 4, which received flotation sulphur at petal fall and in the covers, is next best.

STAYMAN-STATE COLLEGE-1935-1936

Treatment of Plots

- | | |
|------------------------|-------------------------------------|
| 1. Lime Sulphur | Standard |
| 2. " " | 1-75 |
| 3. " " | 1-100 + 4# Catalytic |
| Pre-Bloom | Petal Fall + 3 Covers |
| 4. L.S.-Standard | Flotation 5#-100 |
| 5. " " | Dry L.S. 4#-100 |
| Pre-Bloom + Petal Fall | 3 Cover Sprays |
| 6. L.S.-Standard | Bordeaux 2-6-100 |
| 7. " " | 4# Cop. Phos, 8# Lime, 4# Bentonite |
| 8. " " | 2# Coposil, 3# Lime |
| 9. Check - No Spray | No Spray |

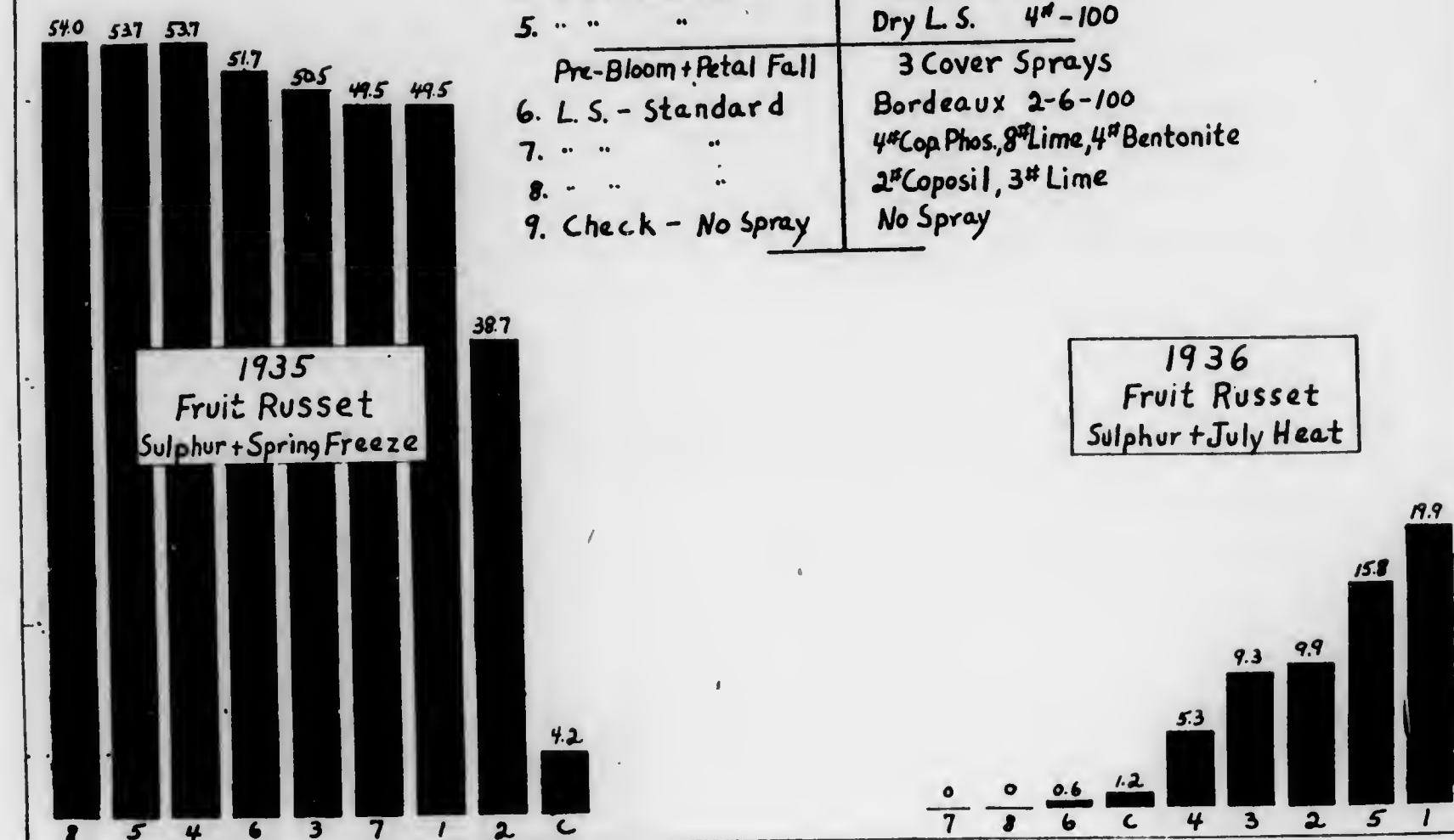


CHART No. 2

Comparison of fruit and foliage injury on Stayman Winesap, State College, Pa. 1936.

Figures at top of columns represent percent of injury. Figures at base of columns are plot numbers corresponding to spray treatments as indicated.

CHART No. 3. Presents a second experiment conducted in a commercial orchard in Adams County, Penna. and involves a comparison between 10 different forms or combinations of sulphur and an unsprayed check. The figures represent averages of 12 replicates for each treatment. Both sets of data were secured by counting fruit and leaves on the trees during August, 200 fruits and 25 terminals per tree were counted. Since the crop was a light one, the fruit counts represent almost the entire crop. As in the experiment at State College, it will be observed that the differences between these materials were brought out very nicely in the case of fruit injury, but were not nearly so pronounced on the foliage. The foliage injury was high on all the plots, running to 17.4% on the unsprayed check. This leaf injury to the check trees was due largely to the attacks of cicada and was emphasized by the hot weather, which doubtless in part explains the high percentage of foliage injury on all the plots. These figures indicate more

severe injury on both foliage and fruit than was experienced by the average grower. This was brought about deliberately by including sulphur in a larger number of sprays than was recommended to the growers by our Spraying Service for the sake of making clear any differences in the relative safety of the kinds of sulphur used. Three schedules were followed. The first using liquid lime sulphur before bloom and various milder sulphurs in the cover sprays. The second using a more dilute liquid lime sulphur fortified with a wettable sulphur throughout the season. In the third, two strengths of liquid lime sulphur were used throughout the season. In the first group (Plots 2, 3, 4 and 6) flotation sulphur and sulcoloid appeared slightly safer than magnetic sulphur for use as cover sprays, though the differences were slight and probably not significant. In the second group (Plots 7, 8, 9, and 10) it appears quite definitely that liquid lime sulphur 1-100 fortified with

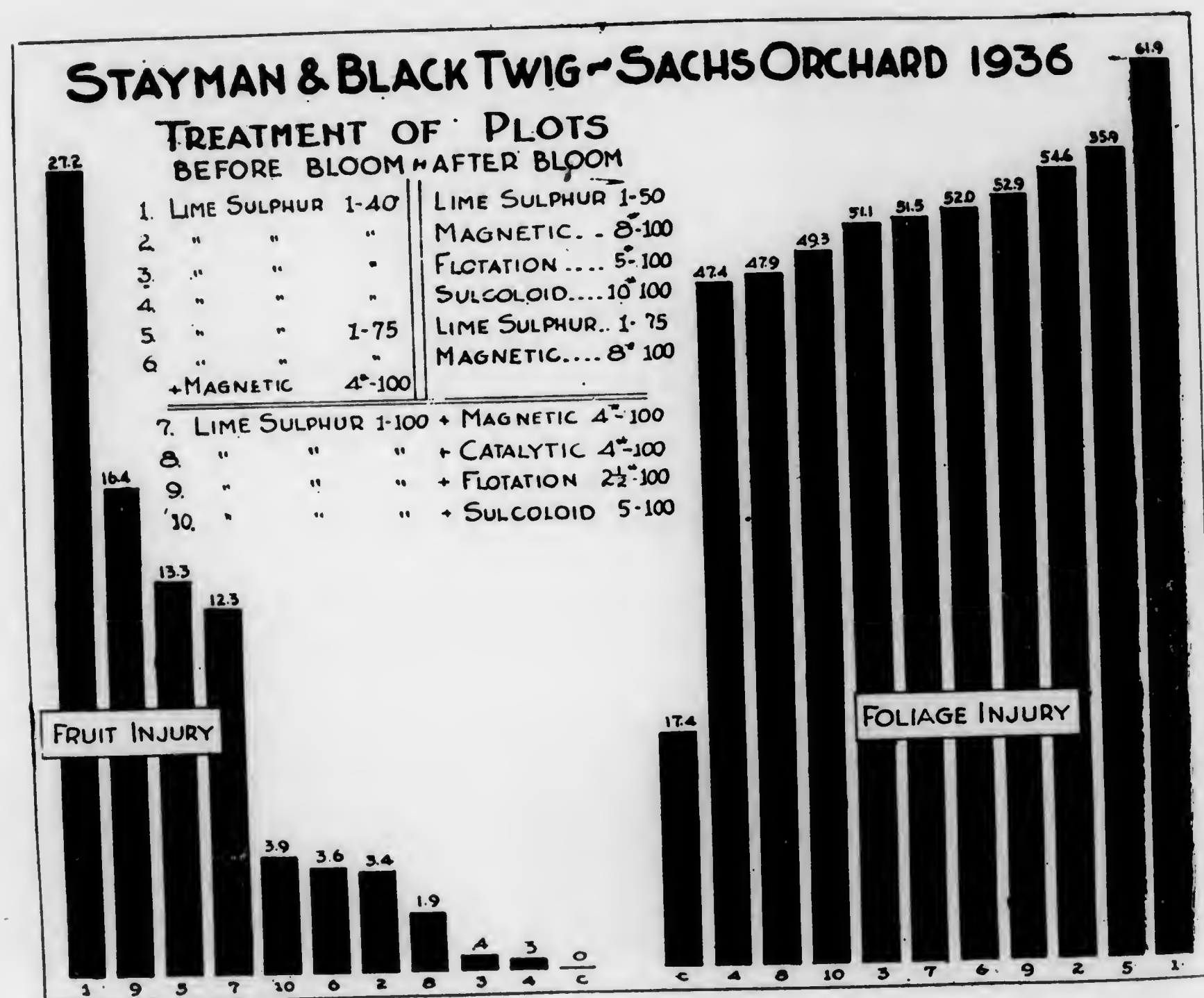


CHART No. 3

Comparison of fruit and foliage injury to a mixed block of Stayman and Black Twig. Sachs Orchard, Adams Co., Pa. 1936.

Figures at top of columns represent percent of injury. Figures at base of columns are plot numbers corresponding to treatments as indicated. All plots received three cover sprays containing fungicide.

either flotation sulphur or magnetic sulphur was definitely more injurious than the same strength of liquid fortified with either catalytic sulphur or Sulcoloid. Flotation sulphur used in this way was decidedly the worst of the four. In the third group (Plots 1 and 5) the dilute liquid lime sulphur was, of course, safer than the standard strength. Of the three safest sulphurs as measured by fruit injury, two also appear among the three safest as measured by foliage injury.

If the story so far appears to place standard liquid lime sulphur in the most unfavorable position with regard to the amount of injury produced, it should be kept in mind that the disease control factor has not here been evaluated.

JONATHAN-SACHS ORCHARD 1936

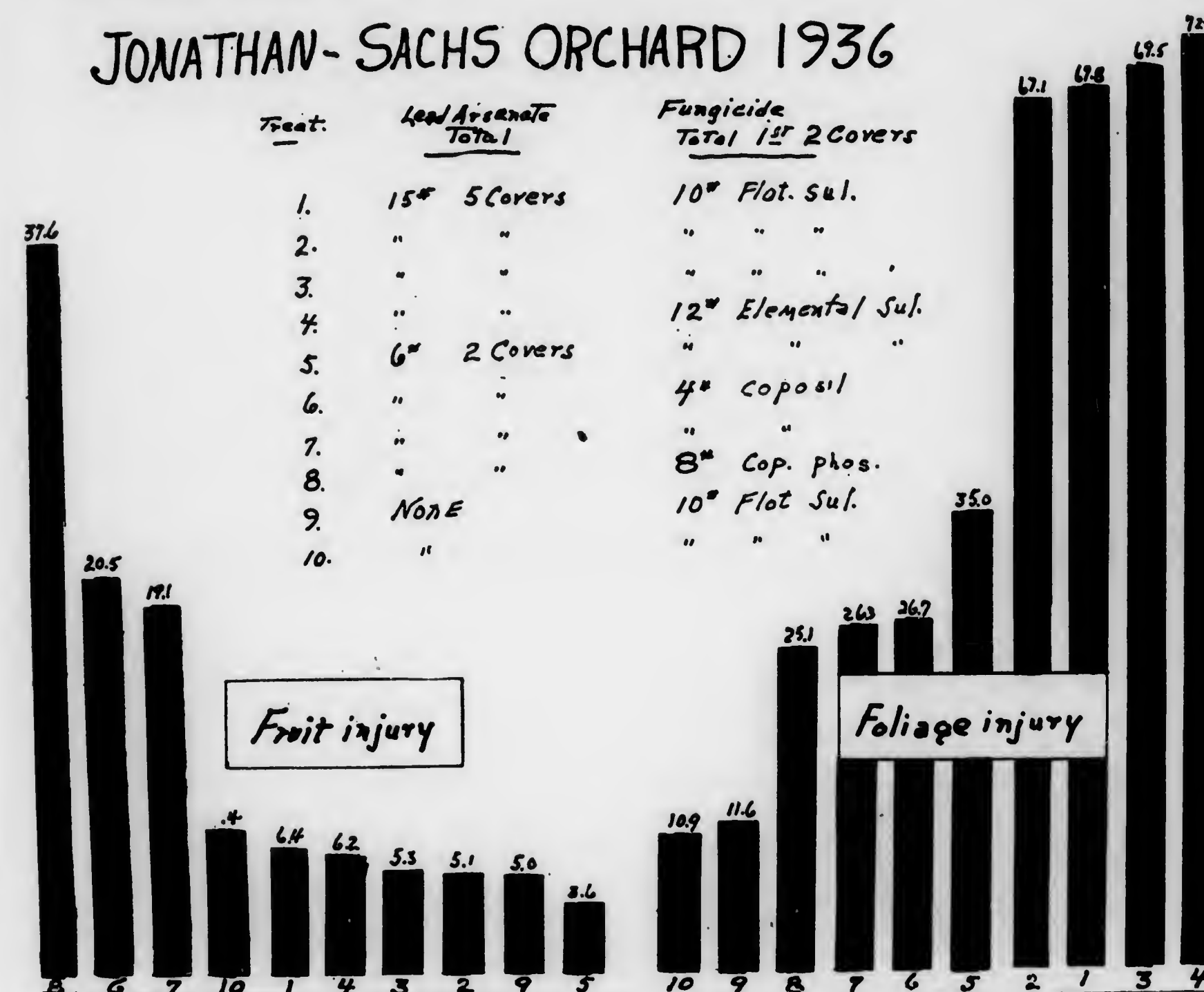


CHART No. 4

Comparison of fruit and foliage injury on Jonathan, Sachs Orchard, Adams Co., Pa. 1936.

Figures at top of columns represent percent of injury. Figures at base of columns are plot numbers corresponding to treatments as indicated.

CHART No. 4. These data on spray injury were secured from some plots laid out primarily for the purpose of testing materials and schedules designed for codling moth control. They are of interest here because of the light they throw on the effect of lead arsenate in complicating the

general picture of spray injury. The figures shown in the first three charts were all taken from experiments where the amounts of lead arsenate were equal on all plots for the season and the kind or amount of the fungicide provided the variable factor. These trees were sprayed uniformly by the grower up to and including petal fall. Our experiment involved five cover sprays, with no fungicide after the first two. In this series, the foliage injury in particular is shown to be in direct relation to the total amount of lead arsenate used in five cover sprays.

Plots 1, 2, 3, 4 received a total of 15 pounds of lead and show twice as much foliage injury as Plots 5, 6, 7, 8 which received a total of only 6 pounds of lead. Correspondingly Plots 9 and 10 which received no lead in the cover sprays show less than half the injury of the plots which received 6 pounds. Comparing Plot 5 (where the fungicide used was sulphur) with Plots 6, 7, and 8 which had the same amount of lead, but with copper as a fungicide, we find that the use of sulphur increased the amount of foliage injury.

The fruit injury was negligible except on the copper plots. In this experiment both Coposil and copper phosphate were used without excess lime as a softener, the lime having been omitted for two reasons: first, because it is known to interfere with the best results from lead arsenate, and second, to find out just how injurious these two forms of copper might be, when used without lime. At the rates of application used, the copper phosphate actually contained six times as much copper as the Coposil so it is not surprising to find it producing the greater amount of injury. The difference in fruit injury among the other plots is not believed to be significant.



KAYSO, Spray Spreader and Adhesive, is an essential aid in producing clean fruit: retards harmful chemical reactions in the tank, thereby making the spray safer to apply. It is especially valuable with Lime Sulphur and Arsenate of Lead as it retards the formation of the objectionable black sludge, but can be used with all standard sprays or combinations.

KAYSO can now be used at the rate of $\frac{3}{4}$ pound to each hundred gallons of liquid spray.

"Spreads the Spray and Makes it Stay"

Send for literature and name of nearest dealer.

GOLDEN STATE SALES CORPORATION
99 Hudson Street New York, N. Y.

SCAB CONTROL vs. SULPHUR INJURY STAYMAN-McINTOSH 1935-1936

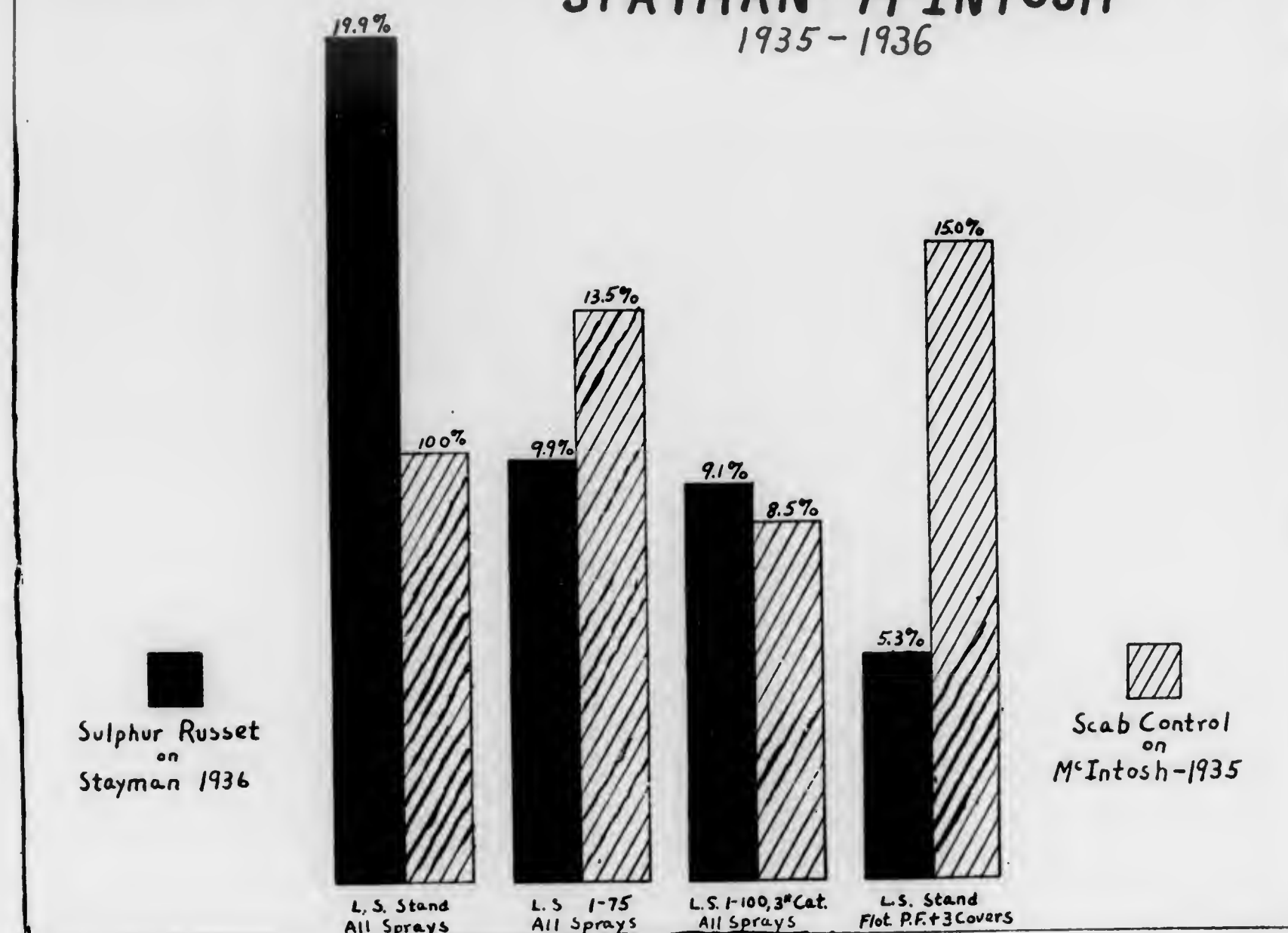


CHART No. 5

Percentages at tops of columns indicate percent of fruit scabby, McIntosh 1935, or russet, Stayman 1936.

CHART No. 5. In this chart an attempt is made to picture for you the behavior of four sulphur spray schedules as tested for a two year period on two different varieties of apples. Here we attempt to balance fungicidal efficiency, as measured by scab control on a scab susceptible variety (McIntosh) in a bad scab year (1935) with injury produced by the same spray schedule on a variety susceptible to sulphur russet (Stayman) in a year (1936) when such injury was pronounced. It will be noticed that, in general, as the injury has been reduced the amount of uncontrolled scab has been increased. The one exception is a combination of 1-100 liquid lime sulphur fortified with so-called catalytic sulphur and used throughout the season. Needless to say we consider this a most promising material and if it continues to prove worthy in other seasons and in the hands of other experimenters it will no doubt find its place. This sort of comparison also shows one of the reasons why the uniform spray program has lost considerable of its uniformity in recent years. It is definitely possible to use a safer form of spray on varieties that are very susceptible to sulphur injury provided only that they are not at the same time extremely susceptible to scab.

SCAB CONTROL vs. COPPER INJURY McINTOSH FRUIT 1935 - 1936

Early Sprays
Through Petal Fall
Standard Liquid Lime Sulphur

3 Cover Sprays
1. Bordeaux 2-6-100
2. Coposil 2-100
Hyd. Lime 3-100
3. Copper Phos. 4-100
Hyd. Lime 8-100
Bentonite 4-100

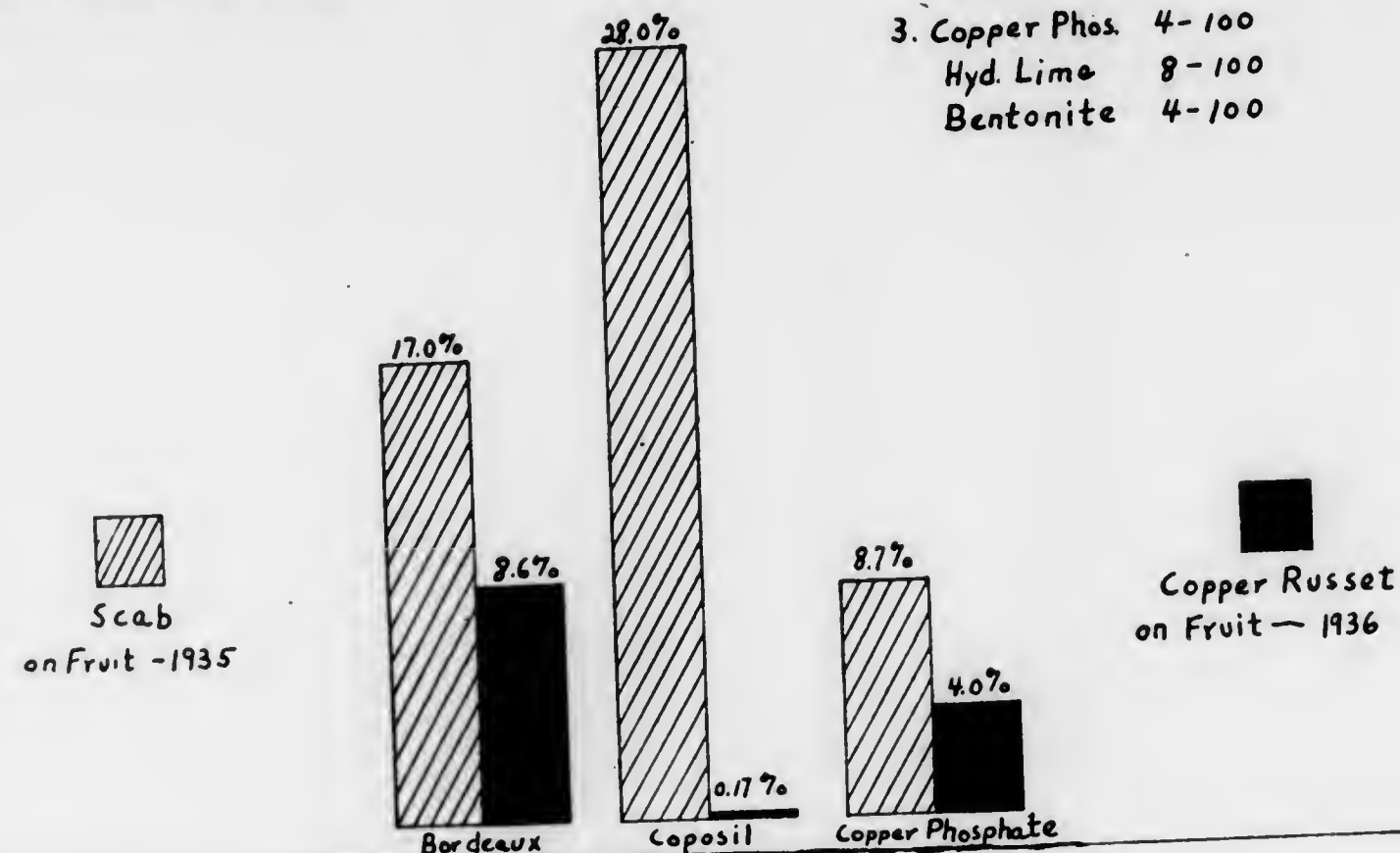


CHART No. 6

Percentages at top of columns indicate percent scab for 1935 and russet for 1936.

CHART No. 6. Spray schedules designed to give a maximum of scab control in the early sprays and a maximum of safety from injury in the cover sprays have led to an increasing use of Bordeaux cover sprays.

In Pennsylvania we have not generally recommended Bordeaux cover sprays but we are interested quite definitely in the possibilities of finding a copper spray as effective as Bordeaux and less productive of copper injury. This chart shows two years' results with three of these copper sprays used as cover sprays, following standard liquid lime sulphur through petal fall. The figures are from the variety McIntosh which is not particularly susceptible to copper russet but they give a good idea of what may be expected in the way of scab control. Had the copper russet been measured on a variety like Ben Davis our injury figures would doubtless have been much higher, but presumably the three materials would have maintained the same relation to each other.

Bordeaux could doubtless have been made to give better control, but when, as here, it is used weak enough to avoid excessive injury the control is not satisfactory. Coposil used as recommended by the manufacturer evidently does not contain sufficient copper either to control

scab satisfactorily or to produce injury. Copper phosphate has definitely reduced copper injury when combined with Bentonite and lime and has stood up well from the point of view of scab control.

From the figures presented it becomes evident that each one of the principal ingredients of the common spray mixtures is apt to produce serious injury. Such injury cannot at present be entirely avoided if the purpose of spraying is to be accomplished. It is evident that a careful adjustment of spray schedules to varieties and to the main disease and insect problems in any orchard must be made in such a manner as to take into account both control and injury. In many cases excessive injury can perhaps be avoided without too great a sacrifice in control.

THE RELATION BETWEEN SPRAYING METHODS AND APPLE DISEASE CONTROL

R. S. KIRBY, State College, Pa.

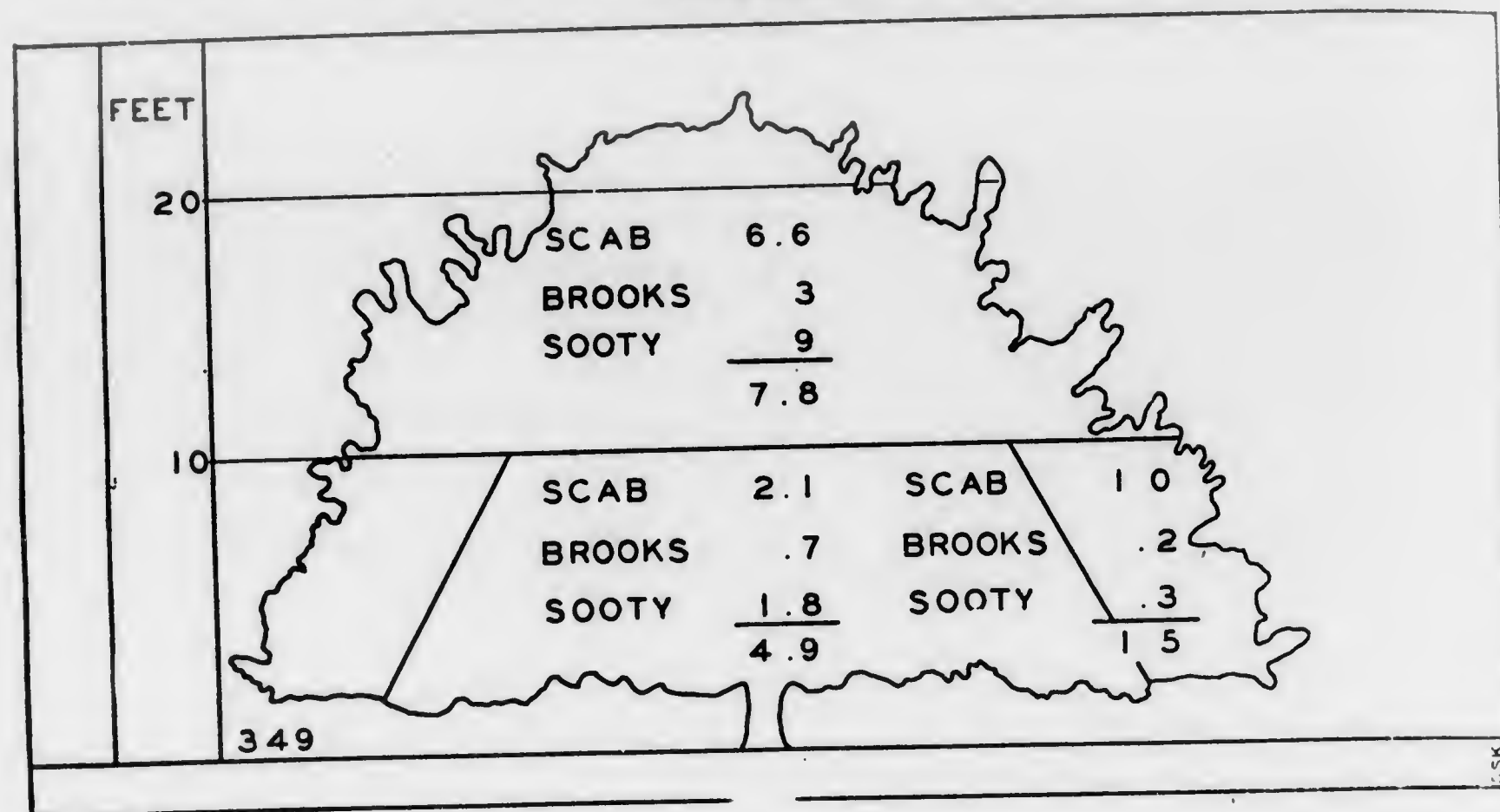
The reason for the differences in disease control obtained by growers has been a question and a study for some time. Spraying information has given uniform timing and materials to the grower with successful control as well as to the grower who has had poor control of scab, Brook's spot, and sooty blotch. Spraying methods then must be the factor causing the difference in control.

This study is a continuation of the one started three years ago and first reported on in 1935. To date, over 450 orchards have been visited and the percentage of diseased apples determined for the lower outside part of the trees, the lower inside part of the trees, and the tops of the trees.

The study has been limited to orchards where the total percentage of diseased fruit on the lower outside part of the trees was five per cent or less. The figure five per cent was taken since that is the upper limit of the aim of spraying information. The lower outside part of the tree was selected as the criterion since the apples on this part of the tree are closest to the person applying the sprays and therefore should obtain the best coverage of spray. When the apples on the lower outside part of the tree have five per cent or less of disease, it indicates that the timing and spray material were such as to hold the total disease within the spraying objective. Differences in the amount of disease in the lower inside and top of the tree can be largely attributed to spray methods. In practice this procedure slightly favored the poorer spraying methods. Severe scab infection on the inside and tops of the trees tends to spread to the apples on the lower outside and raise the total disease above the five per cent limit.

In making the counts, average-sized and average-pruned trees were selected in each orchard. Most of these trees were from 15 to 25 years old and from 17 to 24 feet high, and had a limb spread of 2 to 7 feet greater than the tree height.

FIGURE 1
Percentage of Diseased Apples Occurring in Different Parts of Sprayed Apple Trees.
1934-1936



Percentage and Total Number of Disease Infections per 100 Apples Occurring in
Different Parts of Unsprayed Trees. 1934-1936.

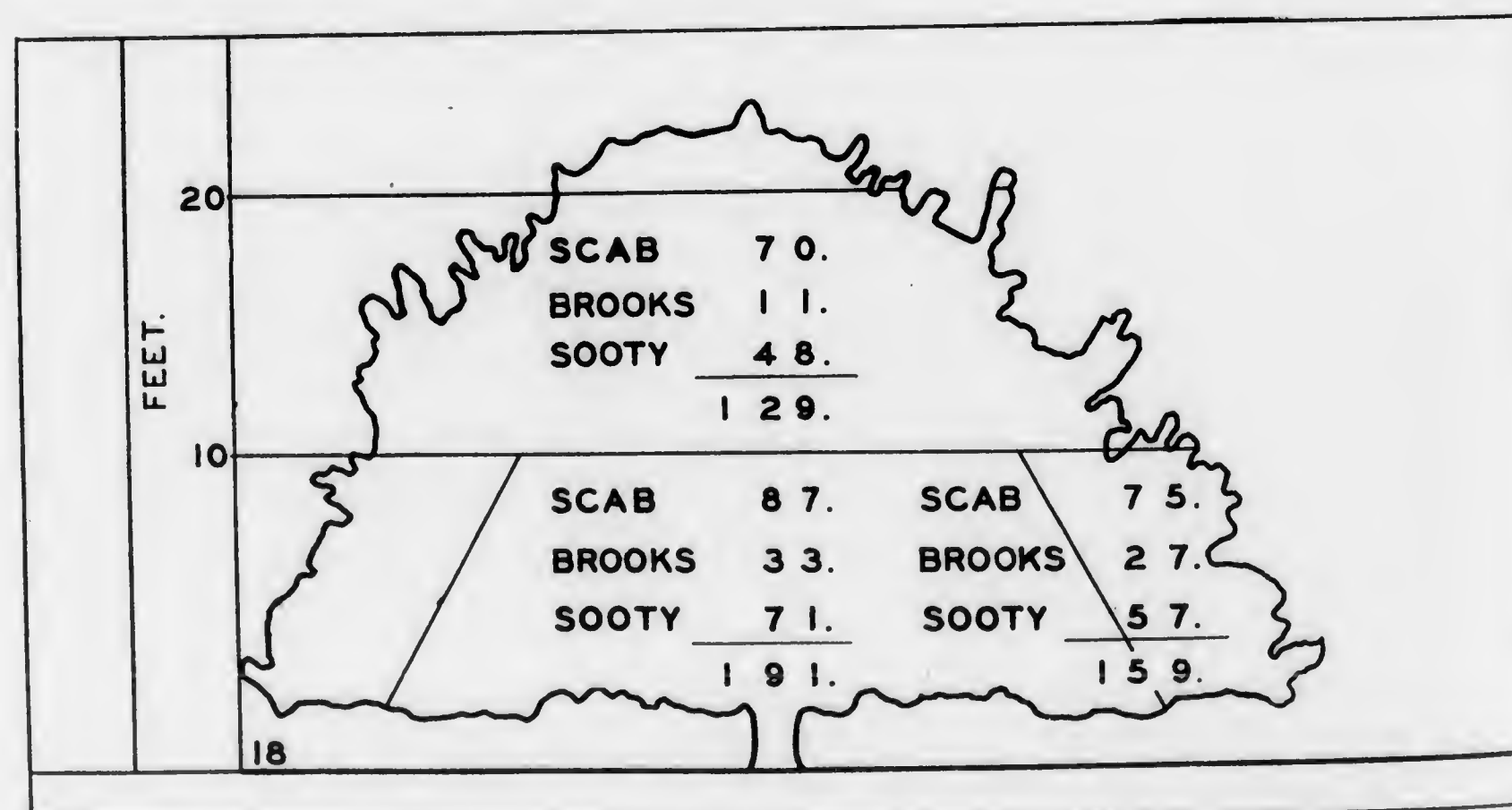
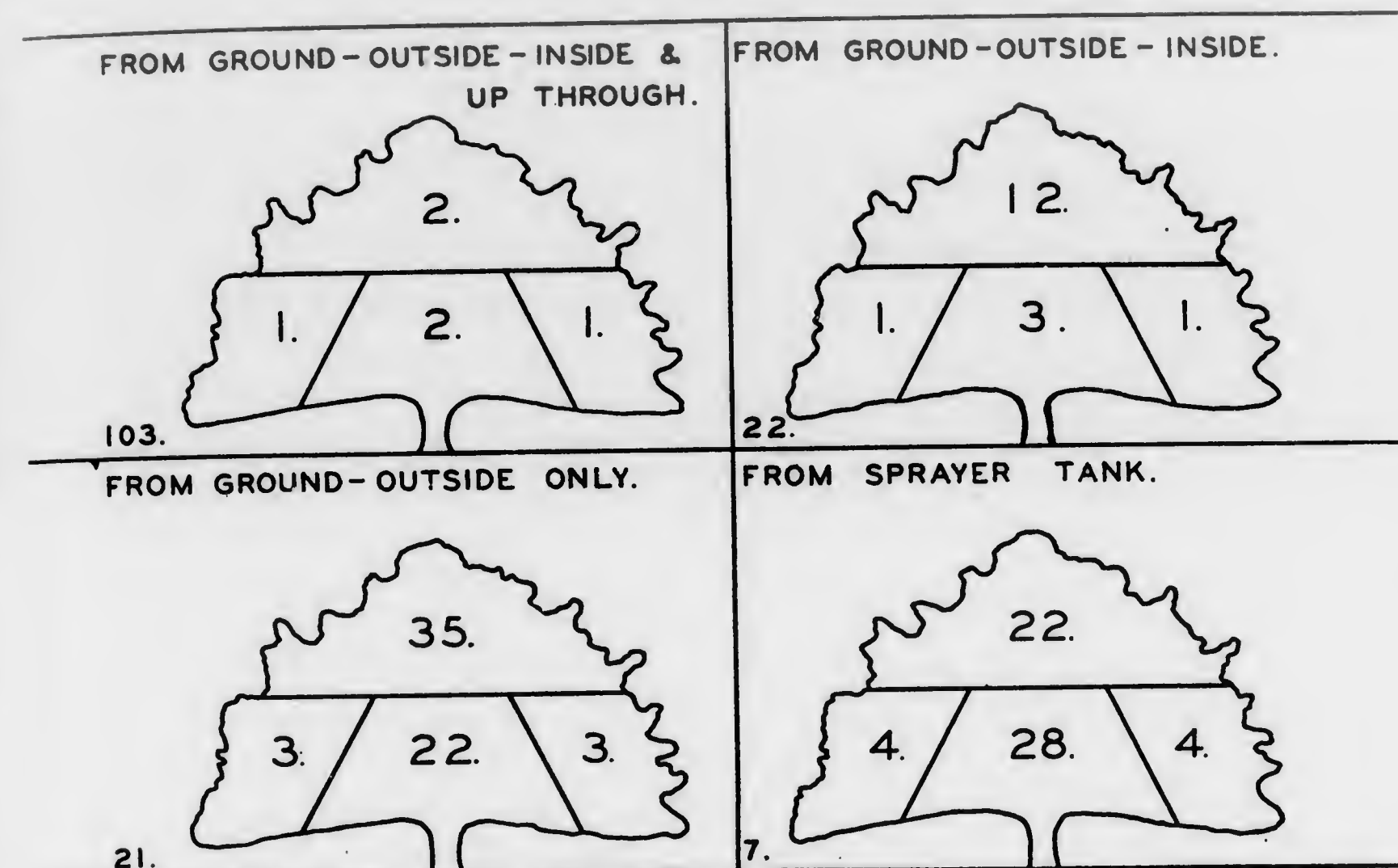
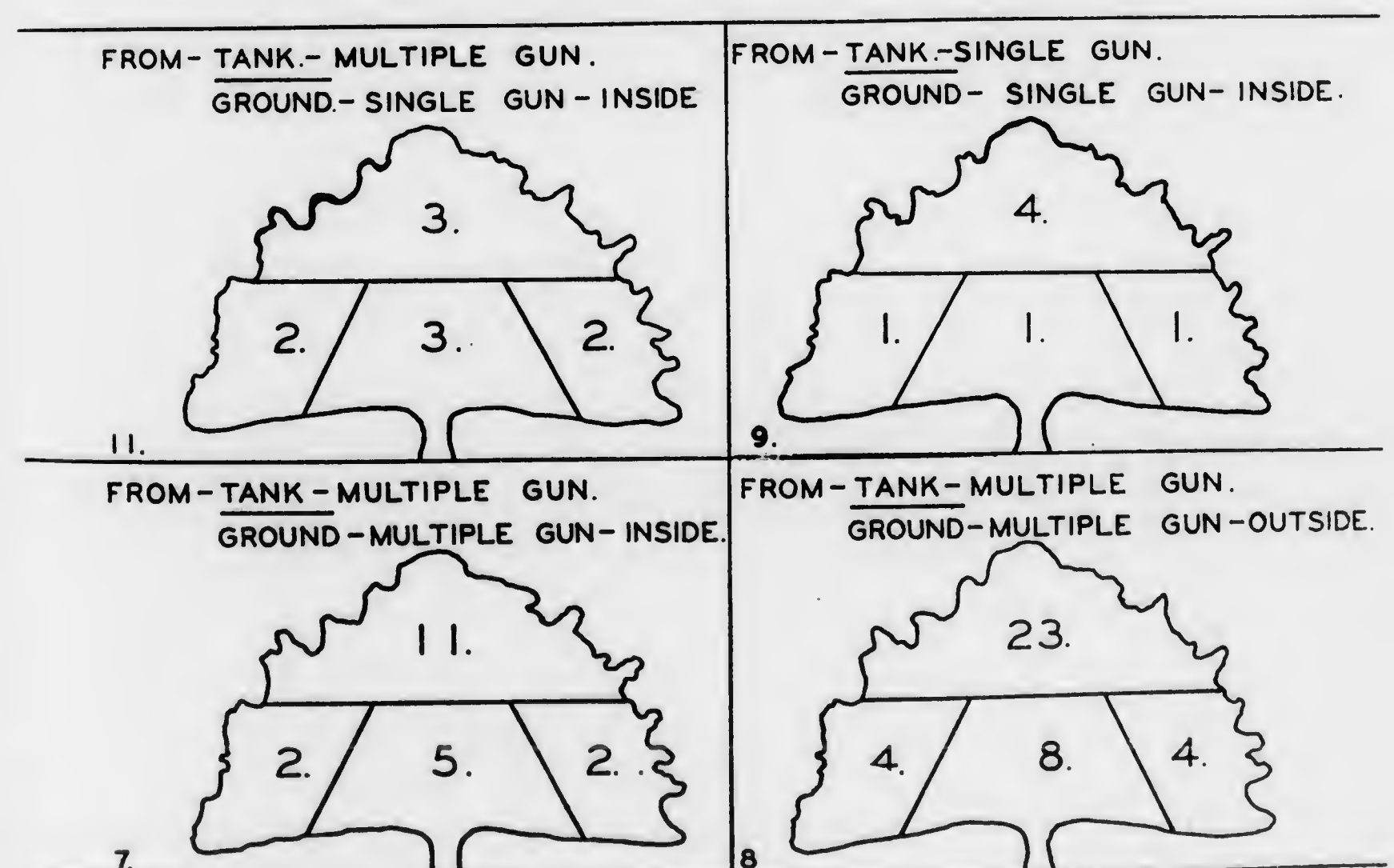


FIGURE 2

SPRAYING WITH ONE SINGLE NOZZLE GUN.



SPRAYING WITH SINGLE AND MULTIPLE NOZZLE GUNS.



SPRAYING WITH MULTIPLE NOZZLE GUN.

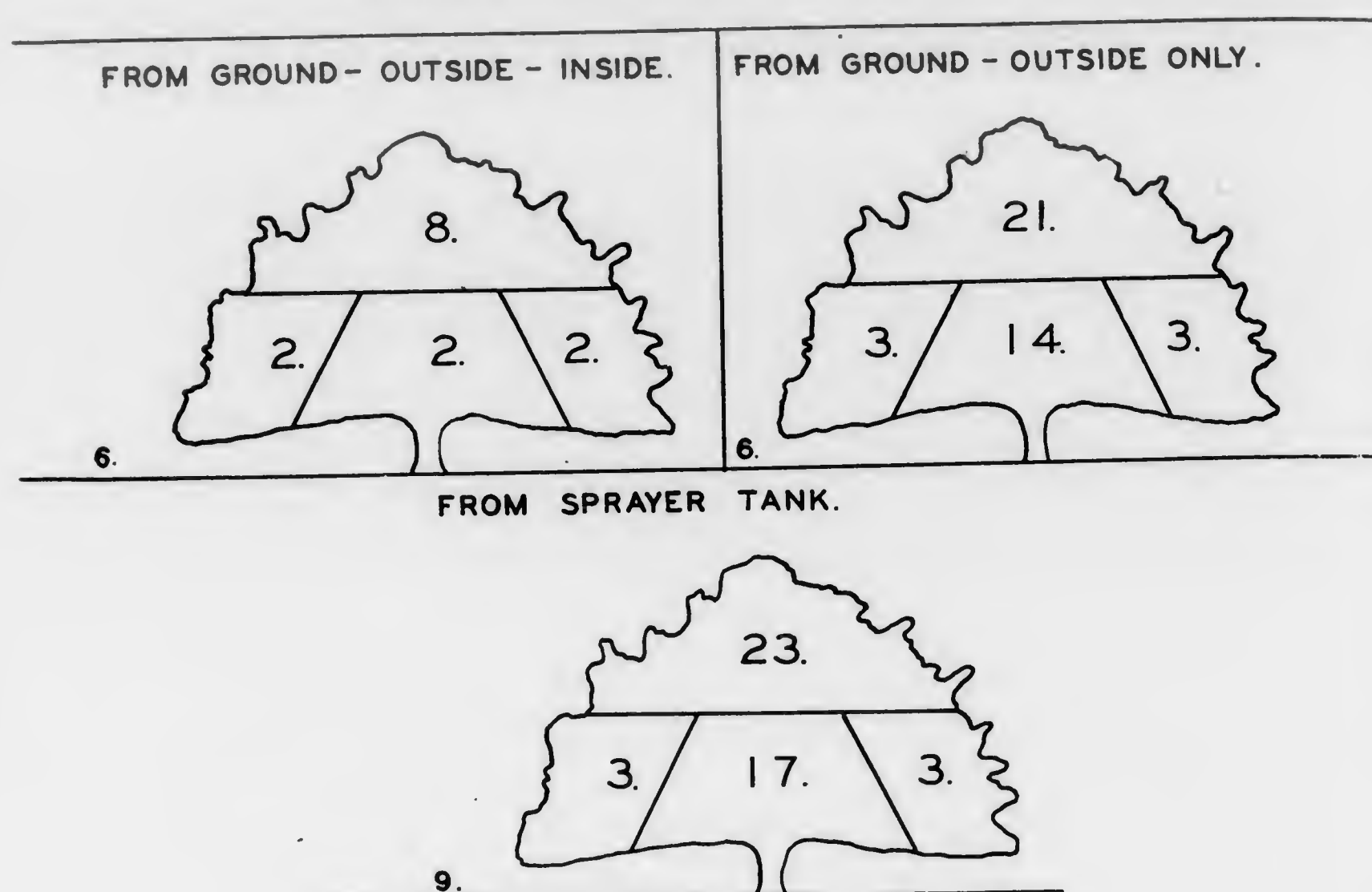


Figure 1 gives the percentage of scab, Brook's spot, and sooty blotch occurring in the 349 sprayed orchards checked where there was five per cent or less disease on the lower outside. The occurrence of disease is also given for the various parts of trees for 18 unsprayed orchards. In the 349 sprayed orchards, the total disease on the lower outside was 1.5 per cent of which scab was 1 per cent and Brook's spot and sooty blotch one-half per cent. On the lower inside parts of the tree there occurred 4.9 per cent total disease or over three times as many diseased apples. In the tops of the trees there occurred 7.8 per cent diseased apples, or over 5 times as many diseased apples as occurred on the lower outside parts of the trees. The question then arises as to the cause of three times disease increase on the inside of the trees and five times in the tops of the trees. If most diseased apples come from the tops of the trees, is this due to the spraying method or to the natural occurrence of more disease on the tops of trees?

This question is answered by the records of disease in unsprayed trees. In unsprayed trees there is less scab, Brook's spot, and sooty blotch in the tops than in either the inside or outside lower parts of the trees. The amount of each of the three important apple diseases is greatest in the lower inside part of the tree. The counts in unsprayed apple trees show that apple diseases, on the average, cause from 1.3 infections per apple to 1.9 infections per apple and that spraying must take into account that diseases are the most severe on the lower inside part of the trees. The counts in the average sprayed tree compared with unsprayed indicates that spraying has not met the situation in the

tops of the trees since the spraying has allowed an increase of five times more disease in the tops than in the lower outside when there should have been a decrease in the top as indicated by the unsprayed trees. These comparisons also indicate that more attention should be given to disease control in the lower inside parts of the trees since disease is normally most severe there.

Figure 2 gives the total percentage of disease occurring in the three different parts of the trees with 11 different spraying methods.

Spraying with Single Nozzle Guns

A single nozzle spray gun was employed in the first four methods. In the first method are the results from 103 orchards where the man applying the spray went inside the trees and sprayed the underside of the lower branches, made a special effort to spray up through the inside of the tree so as to thoroughly cover the underside of the top branches, and then sprayed the outside. The orchards following this method had one per cent disease on the lower outside and two per cent on apples on the inside and top of the tree. This method gave an average of 1.3 per cent total disease which was the lowest of any spraying method. The method also gave the highest percentage of orchards having five per cent or less total disease. Only two orchards out of the 103 sprayed with this method had over five per cent average disease. The second method is similar to the first with the exception that a special effort was not made to spray up through the inside of the tree to cover the top branches. The 22 orchards found following this method had 12 per cent or six times as much disease on the tops as method one where a special effort was made to spray the tops of the trees from the inside. There was a one per cent increase in disease on the inside of the trees over method one, but the same amount of disease occurred on the lower outside part of the trees with both methods. In the third method, all of the spray was applied by a worker walking around the outside of the tree. In the fourth method, the spray was applied by a worker who rode on the sprayer tank. Both the third and fourth methods show that without inside spraying, the percentage of disease on the lower inside parts of the tree will be 7 to 14 times greater than with inside spraying and that there is a decided increase in the amount of disease in the top and lower outside parts of the trees. Spraying from the tank places the operator nearer the top of the tree than ground spraying and made a decrease in the amount of disease in the tops of the trees.

The results obtained by the growers following the first four methods show that a single nozzle gun is only effective when the operator uses it in such a way as to obtain complete coverage. Inside spraying seemed to be the most important factor in reducing disease in the lower inside parts of the trees and spraying up through the inside was the only method by which disease could be held below five per cent in the tops of the trees.

Spraying with One Multiple Gun

Three methods of spraying with a multiple gun were employed by growers.

In the first method the operator went under the trees and sprayed the inside as thoroughly as possible; then came out and sprayed the outside part of the trees. The six growers using this method obtained successful control of disease on the lower outside and inside of the trees, but had eight per cent of disease in the tops of their trees. The average percentage of disease in this method was 3.7 per cent which indicates that the method even with its tendency toward ineffectiveness in the tops of trees should be considered as successful.

In the second spray method with a multiple nozzle gun, the spraying was accomplished by the operator walking around the outside of the trees. The results of the six growers using this method were very similar to those obtained by the growers using a single nozzle gun in the same manner. There was three per cent disease on the lower outside with a five to eight times increase of disease on the inside and 7 to 12 times increase of disease over the lower outside in the top. The multiple nozzle gun, however, seemed to penetrate somewhat better than the single, as its use resulted in a reduction of over 33 per cent of the total disease in the tree over the single nozzle gun.

In the third method with a multiple nozzle gun used from the sprayer tank, there was an average of 14.3 total disease with the disease reaching 23 per cent in the top of the tree. The multiple nozzle gun as used from the tank by nine growers was approximately 33 per cent more effective than the single nozzle gun used by seven growers from the tank.

Growers spraying with a multiple nozzle gun have not obtained as good disease control as with single nozzle guns when spraying from the ground inside and outside. Growers have obtained better average disease control with multiple than with single guns when spraying only from the outside of the trees.

Spraying with Two Guns, Multiple or Single Nozzle, and Various Combinations

A number of growers having larger orchards are using two guns per tree to speed up the spraying operation. The control of disease in the different parts of trees using four of these methods are given in Figure 2. In each of these methods, one operator is using a spray gun from the sprayer tank and a second operator is spraying from the ground.

In the first combination gun method a multiple nozzle gun was used from the tank and a single nozzle gun was used by an operator on the ground who went inside the tree and sprayed thoroughly. The 11 growers who used this method had an average of 2 per cent diseased apples on the lower outside of the trees and 3 per cent in the lower inside and top. This method like the first with a single nozzle gun gave the nearest approach to the normal distribution of disease in trees. The method gave an average of 2.8 per cent total disease in the entire tree. The second combination method had an operator spraying from the tank with a single nozzle gun and another operator spraying from the ground inside with a single nozzle gun. The nine growers who used this method had the second lowest average disease control (2.3 per cent) for their entire trees. The third and fourth combination methods had

one operator spraying from the tank with a multiple gun and a second operator from the ground with a multiple gun. In the third method the operator sprayed inside while in the fourth method the spraying was only from the outside. Where the spraying was from the ground inside and tank outside the average percentage of disease in the trees was 6 per cent, as compared to 11.6 per cent average disease where the ground man stayed outside the trees.

The four combination methods show that either a single or multiple gun may be used on the tank without causing an appreciable difference in disease control. Furthermore, that inside spraying with a single nozzle gun is the only method whereby the average total disease is held below five per cent.

Chance of Growers to Have Good Control of Disease With Each Method

The charts giving the percentage of disease in trees sprayed by various methods fail to show the chance a grower has with each method to get

FIGURE 3

PERCENTAGES OF GROWERS HAVING GOOD, FAIR, AND POOR CONTROL OF APPLE DISEASES WITH DIFFERENT METHODS OF SPRAYING 1934-1936

Spraying Method	Percentage of Growers Having Each Degree of Disease Control		
	Good 5% or less disease	Fair 5.1 to 10 per cent disease	Poor Over 10.1 per cent disease
Single Nozzle Gun			
Ground—Outside—Inside— Up Through.....	98	2	0
Ground—Outside—Inside.....	64	23	13
Ground—Total—Outside—Inside	92	6	2
Ground—Outside.....	19	5	76
Tank.....	14	14	72
Tank and Ground—Inside.....	89	11	0
Multiple Nozzle Gun			
Ground—Outside—Inside.....	67	17	16
Ground—Outside.....	33	0	67
Tank.....	11	22	67
Tank and Ground—Inside.....	57	14	29
Tank and Ground—Outside.....	43	0	57
Multiple Gun on Tank and Single Gun on Ground—Inside.....	64	18	18

a crop of apples with five per cent or less disease. Smaller and especially open type trees can be more thoroughly sprayed from the outside, also growers vary in their ability to use different types of spray guns. Multi-

ple nozzle guns have likely been penalized somewhat in this summary due to the growers not using them on adequate equipment.

Figure 3 gives the percentage of growers having good, fair, and poor control with each of the different spraying methods. The most significant fact is the comparison of the per cent of growers having successful control when spraying from inside and outside or only from outside of the trees. Where inside spraying was employed approximately 74 per cent of the growers had good control of disease and only 15 per cent had poor control. In spraying from only outside the trees only 24 per cent of the growers had good control and 67.8 per cent had poor control. Of the outside spraying, that applied from the tank only had the lowest percentage of growers having good control or 12.5 per cent. Outside ground spraying had 26 per cent of orchards with good control, and tank and ground outside spraying had 43 per cent of growers having disease control.

SUMMARY OF REMARKS BEFORE PENNSYLVANIA STATE HORTICULTURAL SOCIETY

CARROLL R. MILLER, Secretary-Manager, Appalachian Apples, Inc.
Martinsburg, W. Va.

APPALACHIAN APPLES began work July 1st, after several months of organizing work, among officials and leading growers of the horticultural societies of the four states of this Apple Belt—Pennsylvania, Maryland, Virginia and West Virginia. It was organized as a result of steady decline in apple consumption by Americans over past fifteen years; plus curtailment of our export markets, resulting in chronic over-supply of existing demands for apples.

A. A. is governed by the four state horticultural societies. Each society has three members on the Board of Directors. This places control and management of A. A. squarely in the hands of the growers themselves. Pennsylvania's directors are: H. M. Weigel, Sheldon W. Funk and H. W. Skinner.

The fee basis is one-half cent a bushel on Utility and above apples actually sold the growers from orchards. Growers' statement of the number of bushels sold is the final basis for settlement. This is a "gentleman's organization." First half payments due November 15th; second half payments before February 15th.

A total of 540 growers signed up with A. A. this Spring and Summer. Their early estimates of their crops called for 5,150,000 bushels, Utility or above. This means, including fruit below Utility, that over six million bushels are grown by A. A. members. Total commercial apple production for the four states for this year was twelve million bushels. So A. A. has over 50 percent of the tonnage of the four states back of it;—not a bad record for the first year, at all.

Pennsylvania has 186 members, estimated crop 1,350,000 bushels.

Virginia has 237 members, estimated crop 1,800,000 bushels.

West Virginia has 68 members, estimated crop 1,507,000 bushels.

Maryland has 49 members, estimated crop 506,000 bushels.

This 4-state total of 5,150,000 bushels at $\frac{1}{2}$ cent per bushel would

yield a maximum of \$26,000 GROSS. The Board of Directors played safe; allowed for chances, crop failures, uncollectibles, etc.; and set the year's budget at \$19,000. Determination was made, and has been held to, not to exceed that until money is safely in hand; to pay as we go.

Total paid in to date, from all four states:—\$13,565, reports Treasurer Malcolm M. Brown. Pennsylvania paid in to date \$4,301; Virginia \$3,201; Maryland \$1,261; and West Virginia \$4,648; Allied Industries, \$125.

A. A. needs the balance of the money at once;—cannot proceed with the program until we have additional funds. We need the full \$6,000 more to carry the balance of the year's program, in the minimum.

Have all bills paid, including the big bills for the printed, lithographed and die-cut grocery-store display materials: three million A. A. master-labels: of which $2\frac{1}{4}$ million were used this fall.

We have paid out \$11,957; have a balance (as of Jan. 6) of \$1,608. This is "ear-marked" for the Baltimore, Md., "test city" campaign we are now arranging there. The campaign opens Jan. 22, continuing through February 5th; with complete newspaper and radio advertising backing up the intensive work of organizing the grocers of the city.

We have lined up 1,800 grocery stores in Baltimore to aid in this. Of these 1,800, at least 525 of the largest will aid by using their own advertising space to boost apples and will arrange apple displays in their own stores, in addition to using our display materials. The A. & P. stores (250); the American Stores (200) and the Sanitary Stores (75); will carry this complete assistance:—displays, their advertising, and our display materials. Many of the 1200 other stores will also.

Baltimore is the first city in which a complete "test" campaign has been made. Late arrival of funds from growers delayed this work. We could not proceed until we knew the money was coming in, for certain. The small budget this year (\$19,000) has kept us from using many methods of advertising and sales promotion which we know are very valuable—have proven their value with other fruits. We have not been financially able to do any health work among children and schools; nor among physicians; little or no direct advertising; few food shows; a number of such things had to be foregone, regretfully.

Decision of Board of Directors was to center our efforts on "Grocer Service;" because of value of this work and because it can be carried on with limited funds. One man can work at this, in field as large as he can cover; or five men can work a field five times as large. We have one grocer-service man, James A. Higgs; should have more. Higgs has "worked" Louisville, Ky.; Cincinnati, Ohio; Charleston, W. Va.; and is now working Pittsburgh, Pa. He will return to Baltimore to wind-up details of the campaign there; and the week of Feb. 25, Higgs and Secretary Miller, who together worked Baltimore for the campaign, expect to go to Philadelphia, to put on an organization campaign among the grocers there. But they will not be able to use the complete program. Not enough money seems available now to use newspaper and radio backing, except what we can persuade the bigger stores and chains who

use these themselves to give us. Newspaper and radio coverage in Philadelphia would cost something over \$3,000. Unless payments come in in a hurry, that amount will not be in hand, and we will have to do the best we can without it. The newspaper and radio assistance is very valuable and desirable in this work.

But much good can be done without it. By organizing the grocers, we can stir them to put additional effort into selling apples to their customers. The grocer is "key man" in food distribution. He can either increase apple sales by displaying and "pushing" apples; or he can cut down apple sales by putting them in out-of-the-way places in his store and pushing something else. So he is a valuable man to work with.

We furnish the display materials to those grocers asking for it. We supply it in "store sets"; each set rolled or packed, and including;—

1. "laughing apple" window streamer, lithographed in 4 colors.
2. "laughing apple" window or store interior posters, lithographed.
50. rotogravure folders, containing recipes and apple information, to be placed on the store counters; customers helping themselves.
- 2 Price cards, to fit over apple basket or display bin.
- 2 Grocer newspaperettes "THE APPALACHIAN APPLE BASKET," for store manager and staff. This piece emphasizes two things we hope to get across to the grocer;—the nice profit in handling apples; and the ease with which apple displays can be built, in store windows or interiors.

These sets cost us about 26 cents each. They are given to grocers without any cost. But only to grocers we are satisfied will make good use of them. The grocers really approve of this line of display materials. They tell us it is "Good Stuff"; attracts customers interest in apples. Grocers are glad in most cases to receive it and in many cases go to some length to stage apple displays to go along while they are using it. We ordered a million of the rotogravure folders; 80,000 of the "laughing apple" streamers; 50,000 recipe books; the supply of which is almost exhausted now and will have to be re-ordered, with improvements.

So far, we have placed (or are placing) this display material in 8,760 grocery stores, principally in the cities and adjoining areas of Louisville, Cincinnati, Charleston, W. Va., Baltimore. Within a few days we should have several thousand sets in Pittsburgh stores, as Higgs is working there now among the grocers. We "work" these cities as fast as we can. We expect to work Philadelphia shortly; several smaller Southern cities; and a couple more Northeastern cities, before the apple selling season stops, about April 1st.

In these 8,760 grocery stores into which we have reached, we have placed 517,000 pieces of apple advertising material; principally the rotogravure folder, of course, as fifty of these go into each store. We have already used 380,000 of these; will have practically the entire million placed before we finish work this season.

Then we have put out 106,000 of these Variety leaflets; for Staymen Yorks, Romes and the different varieties; telling something of the best

use of that variety; giving some receipes, etc. They go on top of the basket face; just under the lid; one or two or more to a basket. The growers pay most of the cost of these. We furnish them at \$1.50 per thousand leaflets; and they can be printed with your own orchard name at a slight added cost. They are effective—get into the consumer's hands; for we have received many calls for the recipe book mentioned in the leaflet.

We have been very fortunate with our publicity work this far. Four of the biggest dailies of the Central East have given us full pages of apple pictures in their Sunday rotogravure sections;—the Pittsburgh Press, Baltimore Sun, Washington Star and Washington Post.

A number of important magazines have given us full feature articles on apples, with pictures; and we have a whole file of newspaper and magazine articles of smaller size. This is most valuable advertising. Advertising men call it "tradition building." And it is the most effective way to combat the spray residue fear and propaganda. It builds up solid confidence and liking for the Apple Industry. We owe these newspapers and magazines a real debt of gratitude for their fine cooperation in this.

We have been busy also with a lot of lesser things;—National Apple Week, when we had special display windows in Pittsburgh, Philadelphia and Washington; with The Apple Fair at Martinsburg; with a Pittsburgh cooking school; at International Apple Association Convention; at the Pennsylvania Farm Show; with Kiwanis Clubs and other organizations: building up a file of apple photographs, and files of health and nutrition work in apples.

We have gotten out letters to practically all the better apple buyers and handlers of the United States; and to many in Europe, telling about A. A. As a result, we have our display materials in England, Holland, Palestine, in small quantities, of course, as well as in the U. S. And we have attended to the correspondence from our 540 members. If any one thinks keeping up with correspondence from an organization of 540 members is a light job, let them try it once. We have distributed 2¼ million A. A. Master-labels to our members.

This is a brief, sketchy report of our activities the first six months of our life. Apple sales promotion is new work. It has to be learned by trial and experience. Other fruits and vegetables have their promotion work; and their methods in part are adaptable to apples; but not as a whole. Apples are a separate product, and must be promoted in their own way. We are learning rapidly.

As to results;—we are not claiming any, definitely, this first six months, for A. A. alone. But we do say that, working in conjunction with the four other regional apple advertising organizations;—namely Washington State Apples, Inc., and Pacific Northwest Fruits, Inc., each with \$150,000 to spend; and with New York-New England Apple Institute, the National Apple Institute—AND APPALACHIAN APPLES—that the American public has been reminded of apples many, many more times than ever before; and that apples are moving into consumption easily and at much higher prices than for several years past; which is the goal of this promotion work.

1936 MEMBERS STATE HORTICULTURAL ASSOCIATION

Name	Address	County
Abraczinskas, Andrew	Catawissa, R. D. 2	Columbia
Acme Veneer Package Co.	Orchard Park, N. Y.	Chester
Adam, J. N.	West Chester, R. 5	
Adams Co. Fruit Pack. & Dist. Co.	Biglerville	Adams
Aiken, J. V.	Portersville, R. 4	Butler
Allen, S. Guy	New Park	York
Allen, W. F. Co.	Salisbury, Md.	Franklin
Allen, Howard G. & Sons	New Park	
Allison, H. W. Estate	Shippensburg	
American Cyanamid Co.	30 Rockefeller Plaza, New York	
American Lime & Stone Co.	Bellefonte	Centre
Ammon, John	New Wilmington	Lawrence
Anderson, Ralph W.	Fawn Grove	York
*Anderson, H. W.	Stewartstown	York
Anderson, H. M.	New Park	York
Anthony, R. D.	State College	Centre
*Anwyll, Harry L.	Harrisburg	Dauphin
Aspers, D. C.	Aspers	Adams
*Atkinson, D. W.	Wrightstown	Bucks
Atkinson, R. E.	Wrightstown	Erie
Backus, H. E.	North East	
Bailey, M. V.	Pennington, N. J.	Snyder
Bain, J. M.	King & Front St., Northumberland	Allegheny
Baldesberger, W. P.	Bridgeville, R. D. 2	Lancaster
Balmer, Clayton G.	Manheim, R. 1	Berks
Balthaser, G. W.	Wernersville	Lycoming
*Banzhaf, W. H.	Muncy	Chester
Barnard, C. P.	Kennett Square	Erie
Baron, W. E.	McKean	Franklin
Barr, I. C.	Greencastle, R. 2	
Barton, Edwin W.	Shrine Orchard, Finksburg, Md.	
*Bartram, Frank M.	Kennett Square	Chester
*Bartram, G. Maurice	West Chester	Chester
*Baughner, George L.	Aspers	Adams
*Baughner, H. G.	Aspers	Adams
Bean, John Mfg. Co.	Lansing, Mich.	York
Bear, John W.	York, R. D. 10	York
Bear, Paul A.	Mount Wolf, R. D. 4	York
Bear, Jacob R.	York, R. D. 10	York
Bear, Arthur	York, R. D. 10	York
Beaverbrook Farm	Brandywine Summit	Chester-Delaware
Beaverson, Bertha	York, R. 7	York
Beck, A. F.	Perkasie, R. 1	Bucks
Beck, John A.	New Columbia, R. 1	Union
Beers, T. S.	Blairsville, Box 235	Indiana
Bell, R. H.	Bureau of Plant Industry, Harrisburg	Dauphin
Bender, L. J.	Allentown, R. 4	Lehigh
Benn, Robert P.	Bangor, R. 5	Northampton
Benner, Roy	Perkasie	Bucks
Berlew, Geo.	Dallas, R. D. 3	Luzerne
Bethany Orphans Home	Womelsdorff	Berks
Bikle, Philip M. Jr.	Chambersburg, R. 6	Franklin
Bikle, F. C.	Fayetteville, R. 1	Franklin
Bingham, W. O.	St. Thomas	Franklin

* Life Members.

Name	Address	County
Bingham, A. H.	St. Thomas	Franklin
Black, H. M.	Idamar, R. D.	Indiana
Blaine, George W.	North East	Erie
*Blessing, David H.	Newville, R. 1	Cumberland
Blevins, Lee	Stewartstown	York
Boak, J. A. & Sons	New Castle, R. 4	Lawrence
Bohleyer, Weller	Troy	Bradford
*Boles, McClellan	Hanlin Station	Washington
Bolinger, Geo. H.	New Castle	Lawrence
*Boltz, Peter R.	Lebanon	Lebanon
Borland, J. S.	Indiana, R. 7	Indiana
Bountiful Ridge Nurseries	Princess Anne, Md.	
Bovard & Baldwin	655 E. Washington St., New Castle	Lawrence
Boyer, W. A.	Selinsgrove	Snyder
Boyer, Jay	Mt. Pleasant Mills	Snyder
Boyer, Ira C.	Middleburg, R. 3	Snyder
*Boyer, John F.	Middleburg, R. 4	Snyder
Brace, Harold G.	Dallas, R. D. 3	Luzerne
Bream, D. M. Co.	Chambersburg	Franklin
Bream, John	Orrtanna	Adams
Brehm, G. W.	Fayetteville, R. 1	Franklin
*Breidenbaugh, H. L.	Boyetown	Berks
Bricker, Dr. E. B.	Lititz	Lancaster
Breidenbaugh, Herbert	Martinsburg	Blair
Brindle, Geo. R.	Chambersburg, R. 1.	Franklin
Brinton, H. C.	Hanover	York
Brossman, Morse	Ephrata, R. 4	Lancaster
Brown, Bert C.	Marion Center, R. D. 3	Indiana
Brown, H. W.	Allentown, Box 576	Lehigh
Brown, Robt. M.	McDonald	Allegheny
Brown, M. G.	Fawn Grove	York
Brown, J. Turner	New Park	York
Brown, Norman C.	Waynesboro, R. D. Box 285	Franklin
Brown, C. Earl	Chambersburg	Franklin
Brown, Sam A.	Painesville, Ohio, P. O. Box 143	
Brubaker, Daniel A.	Ephrata, R. 2	Lancaster
Brubaker, Levi H.	Lancaster, R. 1	Lancaster
Bruner, W. W.	Paxtonville	Snyder
Bucher, F. S.	Reamstown	Lancaster
Buffalo Valley Fruit Farms	Mifflinburg	Union
Burrill, Arthur W.	Lorane	Berks
Carpenter, G. S. L.	Hancock, Md.	
Central Chemical Co.	Baltimore, Md.	
Chapin, Irvin	Shickshinny, R. 3	Luzerne
*Chase, Charles T.	Bala	Montgomery
Chumard, Llewellyn	Ariel	Wayne
Clark, A. L.	Olyphant, R. D.	Lackawanna
Clemson, Leonard G.	Halifax	Dauphin
Christman, William	Indiana, R. D.	Indiana
Coffroad, L. C.	New Holland, R. 2	Lancaster
Conrad, Hamer	Indiana	Indiana
Coon, Sam	Clarks Summit	Lackawanna
Cooper, C. A.	1000 Highland Ave., Coraopolis	Allegheny
Cornwall Farms & Orchards	Cornwall	Lebanon
Cosklo, Andrew	Carbondale, R. D.	Lackawanna
Cowan, W. H.	Martinsburg, R. D. 2	Blair
Cox, J. W.	New Castle, R. D. 5	Lawrence
Craighead, E. M.	2742 N. 2nd St., Harrisburg	Adams
Crawford Bros.	Fayetteville, R. D. 1	Franklin
Creasy, Luther P.	Catawissa, R. D. 1	Columbia

* Life Members.

Name	Address	County
Cressman, C. K.	Barto, R. D.	Berks
Crist, James D.	Walden, N. Y.	
Criswell, R. T.	12 N. 2nd St., Chambersburg	Franklin
Crossman, P. S.	Girard	Erie
Crouse, E. A.	Gettysburg	Adams
Crowell, Samuel B.	Edgemont	Delaware
Crowell, A. & T.	Avondale	Chester
*Cummings, Joseph F.	Sunbury	Northumberland
Cutler, Joseph S.	Dunmore	Lancaster
Daugherty, P. H.	Upper Strasburg	Franklin
*Davenport, Eugene	Plymouth	Luzerne
Davidson, N. H.	Chambersburg	Franklin
Davis, E. N. G.	Newton Square	Chester-Delaware
Deemer, A. F.	Marion Center, R. D.	Indiana
DeLong, Cletus Y.	Mertztown, R. D. 2	Berks
Dennis, A. J.	Zionsville, R. 1	Lehigh
Dennis Brokerage Co.	204 Franklin St., New York City	
Dibble, Samuel E.	Shelocta, R. 1	Indiana
Dietterle, Andrew	New Wilmington, R. 1	Lawrence
Dickenshied, F. S.	Zionsville	Lehigh
Dickey, Samuel	Oxford	Chester-Delaware
*Dickinson, B. M.	5634 Stanton Ave., Pittsburgh	Allegheny
Difenderfer, Geo.	741 Walnut St., Allentown	Lehigh
Diehl, J. M.	49 N. Jonathan St., Hagerstown, Md.	
Diehl, Ed. B.	St. Thomas	Franklin
*Dill, Robert	North East	Erie
Ditzler, Paul	Gardners, R. 1	Adams
Diven, W. C.	Livermore, R. D. 2	Indiana
Dixon, Chas.	St. Thomas	Franklin
Dixon, William	St. Thomas	Franklin
Dow Chemical Co.	Midland, Mich.	
Druck, Albert	Wrightsville, R. 2	York
Duke, D. R. & B. F.	60 W. Queen St., Chambersburg	Franklin
Dunlap, Ed.	Blairsville	Indiana
*Dunlap, James M.	Shippensburg, R. D. 2	
*Dunlap, R. Bruce	Dept. of Welfare, Harrisburg	Dauphin
Ebling, Aaron	Reading, R. D. 2	Berks
Edgerton, J. Russell	Westtown	Chester
Edminston, William	New Wilmington, R. D.	Lawrence
Edwards, Harold	Clarks Summit	Lackawanna
Elder, George K.	Lewiston, Maine	
*Eldon, Robert M.	Aspers	Adams
Enck, Warren	Biglerville	Adams
Erb Bros.	305 E. Front St., Lititz	Lancaster
Eshleman, John E.	Florin	Lancaster
Etter, Frank L. & E. C.	Chambersburg, R. 3	Franklin
Evans, Roland	Longwood Farms, Kennett Square	Chester-Delaware
*Evans, W. H.	Plainsville	Luzerne
Everhart, W. J.	219 E. Philadelphia St., York	York
Estes, Mrs. W. J. Jr.	Blue Hill Farm, R. 4, Bethlehem	
Fagan, F. N.	State College	Centre
Fahs, David C.	York, R. D. 9	York
Fairhope Farm	Glen Mills	Chester-Delaware
Fairman, Francis	Creekside, R. D. 1	Indiana
Feldman, Chas. S.	Chambersburg, R. 6	Franklin
Felty, G. O. B.	Millersville	Lancaster
Fenstermacher, P. S.	Allentown, R. 3	Lehigh
Fetterman, J. Gordon	Media	Delaware
Fetters, Clark	Gardners	Adams

* Life Members.

Name	Address	County
Flick, Earle	800 N. 11th St., Reading	Berks
Fidler, W. B.	Aspers	Adams
Fisher, Fred	Wernersville	Berks
Fisher, Isaac L.	Soudersburg	Lancaster
Fisher, Isaac	Gordonville	Lancaster
*Fletcher, S. W.	State College	Centre
Flinchbaugh, J. J.	Loganville	York
Flinchbaugh, H. H.	Loganville	York
Flora Orchard Co.	Wrightsville	York
Fogelsanger, Crist	Shippensburg	Franklin
Fogelsanger, W. H.	210 N. Prince St., Shippensburg	Franklin
Follmer, Harold W.	Sleinsgrove	Snyder
Forry, S. E.	Ephrata, R. D. 1	Lancaster
Frants, S. P.	Trucksville, R. D.	Luzerne
*Freed, A. J.	Racine	Beaver
*Freed, W. A.	Racine	Beaver
Frey, Harry E.	York, R. 6	York
Friend Manufacturing Co., L. H. Keller	Bendersville	Adams
Frost, S. W.	Arendtsville	Adams
Fry, John L.	c-o C. K. Whitner & Co., Reading	Berks
Funk, Sheldon	Boyertown	Berks
Gackenbach, C. A.	Orefield, R. 1	Lehigh
Gantert, Theo.	152 N. Front St., Reading	Berks
Garber, Henry F.	Mt. Joy, R. 3	Lancaster
Gardenhour, G. W.	Smithburg, Md.	
Garman, Albert S.	N. Charles St., Manheim	Lancaster
*Garrahan, R. H.	Kingston	Luzerne
Garrettson, Robert	Aspers	Adams
Garrettson, Donald	Aspers, R. 2	Adams
Gates, Galen	Shippensburg	Cumberland
Gaul, Frank	Host	Berks
Gay, Arthur	Dallas, R. D. 3	Luzerne
Gehr, Harvey J.	Waynesboro	Franklin
Gearhart, C. S.	Blairsville, R. D.	Indiana
Geiger, Clinton	Neffs	Lehigh
Geiger, Samuel	Schenecksville	Lehigh
Gelwix, John M.	Chambersburg	Franklin
Gerhard, C. S.	Blairsville, R. 2	Indiana
Getz, Kenneth	North Girard	Erie
Gibson, C. V.	Conoquenessing	Butler
Gibson, Ira E.	Blairsville, R. 1	Indiana
Gibson, W. F.	Yoe	York
Gillan, James	St. Thomas	Franklin
Gillan, R. J.	St. Thomas	Franklin
Gillan, C. F.	St. Thomas	Franklin
Gillan, G. G.	St. Thomas	Franklin
Glaze, Fred L.	Winchester, Va.	Franklin
Glick, Isaac S.	Lancaster, R. 1	Lancaster
Glick, Jonas R.	Gap, R. D. 2	Lancaster
Goldman Package Mfg. Co.	Glassboro, N. J.	
Good, Harvey	Lancaster, R. 8	Lancaster
Goodling, G. A.	Loganville	Lancaster
Goshorn, Taylor L.	Quincy, Box 47	York
Gramm, H. V.	St. Thomas, R. 1	Franklin
Graybill, C. W.	Middleburg, R. 4	Franklin
Graybill, Floyd	Richfield	Snyder
Graybill, J. H.	Manheim, R. 1	Snyder
Grebinger, Herbert	224 Prince St., Millersville	Lancaster
Greenawald, Rev. Geo. A.	Boyertown	Lancaster
*Griest, C. A.	Guernsey	Berks
		Adams

* Life Members.

Name	Address	County
*Griest, Frederick E.	Flora Dale	Adams
Grimshaw, Harry	North Girard	Erie
Gross, H. S.	York, R. D. 10	York
Grove, H. R.	York Springs	Adams
Grove, W. E.	120 N. 6th St., Chambersburg	Franklin
*Grove, W. E.	York Springs	Adams
Guyton, T. L.	c-o Sherwin-Williams Co., Bound Brook, N. J.-	Lehigh
Haas, William	Coplay, R. D. 1	Wayne
Haase, Alfred H.	Narrowsburg, N. Y.	Wayne
Haase, Herman	Narrowsburg, N. Y. R. D. 1	Beaver
Haberman, Mrs. T. C.	Baden	Snyder
Hackenburg, Chas.	Mt. Pleasant Mills	Lancaster
Hackman, Willis	Denver	Luzerne
*Haddock, John C.	Wilkes-Barre	
Haden, Chesley A.	Crozet, Va.	Franklin
Hafer, Harry D.	Fayetteville, R. 1	Franklin
Hafer, John A.	Chambersburg, R. 5	Franklin
Hafer, Quigley	Chambersburg	Franklin
Hafer, Roy	Fayetteville, R. 1	Philadelphia
Haines, Robert B. 3rd	Hereford, Box 56	Adams
Hales, P. H.	Orrtanna	Erie
*Hall, L. C.	North Girard	Indiana
Hamilton, R. W.	Home, R. D.	Lawrence
Harbison, Wm.	New Castle, R. 1	
Hardie Mfg. Co.	20 E. North St., Hagerstown, Md.	Shnyder
Harner, M. C.	Middleburg	
Harrisburg Stencil Works	4 N. 5th St., Harrisburg	
Hart, H. V.	Hagerstown, Md.	
Hartmann, Ernest	Biglerville	Adams
Hartman, Scott W.	Palm	Montgomery
*Hartman, L. E.	Cly	York
Hartman, M. T.	Gettysburg	Adams
Hartzok, J. W.	Marion	Franklin
Harvey, H. R.	Foxburg	Clarion
Hossinger, H. C.	Beavertown	Snyder
Hausman, George B.	Coopersburg, R. 2	Lehigh
*Haverstick, Paul E.	Lancaster, R. 3	Lancaster
Hawkins, E. B.	Delta	York
Hayes, S. B.	Enon Valley, R. 1	Lawrence
Hayman, Guy L.	Northbrook	Chester
Heacock, O. J.	Biglerville	Adams
Heaps, T. Jerome	Street, Md.	York
Hege, H. P.	Fayetteville, R. 1	Franklin
Heinz, Henry	Narrowsburg, N. Y.	Wayne
Heisey, S. A.	Greencastle, R. 4	Franklin
Hernstead, Walter	Honesdale	Wayne
Henry, A. Y.	Barto, R. D.	Berks
Herhold, J. C.	North Girard	Erie
Herr, C. H.	Lancaster, R. D. 2	Lancaster
Herr, J. Z.	Elizabethtown College,	
	Elizabethtown	Lancaster
Hershey, H. S.	East Petersburg	Lancaster
*Hershey, H. F.	Hamburg	Berks
Hertzler, Jacob	Lancaster, R. D. 3	Lancaster
Hess, C. C.	286 Washington St., New York	
Hess, Clayton	Elizabethtown, R. 3	Lancaster
Hess, Paul G.	Waynesboro, R. 2	Franklin
Hess, Ray B.	Mt. Alto, R. D. 1	Franklin
Hess, F. M.	Waynesboro, 601 Main St.	Franklin
Hess, R. C.	Waynesboro, R. 2	Franklin

* Life Members.

Name	Address	County
Hess, T. S.	Wapwallopen, Box 27	Luzerne
Hetrick, A. W.	Beavertown	Snyder
Hicks, Wm.	Honesdale	Wayne
Higgins, W. A.	Dallas, R. D.	Luzerne
Hilbish, W. D.	Painesville, Ohio	
Hildebrandt, John A.	Dallas, R. D. 2	Luzerne
Hildebrant, John E.	Dallas, R. D. 2	Luzerne
Hileman, W. Carl	New Castle, R. D. 3	Lawrence
*Hill, William D.	North East	Erie
Hines, Zenas	Clymer, R. D. 2	Indiana
Hinnershitz, C. Walter	1255 Buttonwood St., Reading	Berks
Hirshberger, L. & Co., Inc.	286 Greenwich St., New York	
Hobson, William	Avondale	Chester-Delaware
Hoehler, H. G.	Universal Gypsum & Lime Co., New York	Butler
Hoffman, H. L.	Butler, Star Route	
Hoge, L. Clark	Leesburg, Va.	
Hood, T. C.	Saltsburg, R. 1	Indiana
*Hoopes, Wilmer W.	West Chester	Chester-Delaware
Hoover, Wm.	Blacklick, R. D. Box 116	Indiana
Horn, W. H.	Chambersburg, R. 10	Franklin
Horner, J. M.	250 Conway St., Carlisle	Cumberland
*Horst, J. Morris	Lebanon, R. 3	Lebanon
*Hostetler, Abram	Johnstown, R. D. 3	Cambria
Hostetter, C. N.	Washington Boro	Lancaster
Hostetter, G. W.	Gap, R. 5	Lancaster
Hostetter, Dr. J. E.	Gap, R. 1	Lancaster
Houser, Jacob R.	Lampeter	Lancaster
Howard, P. H.	Dover, R. 1	York
Howatt, Mrs. Maude	Coopersburg, R. 2	Lehigh
Huber, Herman	Narrowsburg, N. Y., R. 1	Wayne
Huber, Edwin B.	232 S. Main St., Chambersburg	Franklin
*Huey, S. R.	New Castle, R. R. 3	Lawrence
Hutchison, Mrs. T. G.	New Wilmington	Lawrence
Hutchison, J. D.	Rear 84 Scott St., Wilkes-Barre	Luzerne
Hykes, E. S.	York, R. D. 5	York
Ingham, M. M.	New Castle, R. 5	Lawrence
Imswiler, John S.	West Chester	Chester-Delaware
Irey, Allen M.	Boyetown	Berks
Irvin, W. M.	Marion Center	Indiana
Irwin, W. E.	Flora Dale	Adams
Irvin, Wm. F.	Orrtanna, R. 2	Adams
James, D. M.	Bureau of Markets, Harrisburg	Dauphin
Jayne, Allen	Skinner's Eddy	Susquehanna
Johnson, John	New Wilmington	Lawrence
Johnson Orchards	Mooresville, Ind.	
Johnston, R. S.	New Wilmington, R. D. 1	Lawrence
Johnston, Roland G.	Hereford	Berks
Johnston, M. E.	Conoquenessing	Butler
*Johnston, Mrs. F. C.	Dallas	Luzerne
Jones, W. R.	Chambersburg, R. 2	Franklin
Karns, J. H.	Chambersburg	Franklin
Kauffman, A. L.	Bird-in-Hand	Lancaster
Kauffman, J. B.	York, R. D. 7	York
Kauffman, C. E.	Manchester, R. 1	York
Keim, Milton W.	Boyetown, R. 2	Berks
*Keller, Paul J.	Alder Run Orchards, Tyrone	Adams
Kellow, Geo. H.	Scranton, R. 1	Lackawanna
Kendig, Dr. J. S.	Salunga	Lancaster
Kerchner, Harvey T.	Lenhartsville	Berks
*Kessler, Geo. W.	Tyrone	Blair

* Life Members.

Name	Address	County
Kibler, T. F.	North Girard	Erie
King, L. G.	Mt. Wolf, R. D. 1	York
*Kister, U. G.	Etters	York
Kelin, Jack	404 New Market St., Philadelphia	Lancaster
Kleppinger, B. M.	Coopersburg, R. 2	Lehigh
Knappenberger, Thos.	Zionsville, R. D. 1	Lehigh
Knotts, Ralph	Orefield	Lehigh
Knouse, M. E.	Peach Glenn	Adams
*Koehler, Paulus E.	826 Washington Ave., Monaca	Beaver
Krebs, H. B.	Mercersburg	Franklin
Krick, Charles E.	Reamstown	Lancaster
Kuhn, C. E.	Cashtown	Adams
Kuhns, Victor	Allentown, R. 2	Lehigh
Kyle, B. Wm.	Zionsville	Lehigh
Landis, D. M.	Lancaster, R. 7	Lancaster
Landseidel, Clarence	Clarks Summit, R. 2	Lackawanna
Lapp, John F.	Ronks, R. 1	Lancaster
Latshaw, J. E.	Marion	Franklin
Lau, R. E.	York	York
Lau, L. E.	East Berlin, R. D. 2	York
Lau, Rev. I. M.	715 Manor St., York	Lehigh
Laudenslager, Martin	Orefield, R. D. 1	Chester-Delaware
LeBoutillier, Chas.	Wayne	York
Lehman, Geo.	Hellam, R. 1	Erie
Lehman, S. S.	Girard	York
Lehman, Sulvester	York, R. D. 9	York
Liebhart, Samuel H.	Wrightsville, R. 1	Adams
Leiberknecht, M. L.	Mt. Wolf, R. 1	Schuylkill
Lengle, Paul H.	Pine Grove	Cumberland
*Leonard, F. E.	Carlisle, R. 1	Lancaster
Lepole, Walter	Akron	Philadelphia
Leslie, Lee C.	2732 N. 45th St., Philadelphia	Philadelphia
Lewis, S. V.	Wyoming, R. D. 1	Luzerne
Lewis, Nelson H.	Pittston, R. 1	Luzerne
Lightner, E. S.	York, R. D. 11	York
Linde, J. Eric	Orefield, R. 1	Lehigh
Linville, Arthur S.	Media, R. 2	Delaware
Lippy, John D.	Gettysburg	Adams
Livingood, Mrs. Stella	Robesonia	Berks
Livingston, C. C.	New Oxford	Adams
Long, J. C.	340 E. Liberty St., Lancaster	Lancaster
Long, D. Edward	Fayetteville	Franklin
Longenecker, Howard G.	127 E. Main St., Manheim	Lancaster
*Loop, A. I.	North East	Erie
Loop, H. S.	North East	Erie
Loose, H. H.	Menges Mills	York
*Lord, John	Wyoming, R. 1	Luzerne
Loucks, Walter	York	York
Lucabaugh, J. W.	Hanover, R. 6	Adams
Lusk, Fred F.	New Wilmington	Lawrence
McClelland, J. B.	Canonsburg	Washington
McClung, Lewis	429 E. Sheridan Ave., New Castle	Lawrence
McClure Bros.	Quarryville	Lancaster
McClure, Frank	New Castle, R. D. 5	Lawrence
McConnell, D. R.	New Wilmington	Lawrence
McCormick, C. M.	Knox Ave., New Castle	Lawrence
*McCormick, James	Harrisburg	Dauphin
McDonald, R. C.	Shippensburg, R. 3	Cumberland
McDonald, John Y.	Charles Town, W. Va.	
McElliott, Roy	Home	Indiana

* Life Members.

Name	Address	County
*McFarland, J. Horace	Harrisburg	Dauphin
McFarland, Rev. K. W.	New Wilmington	Lawrence
McGinnis, C. R.	523 Oley St., Reading	Berks
*McGeorge, Mrs.		
Katherine L.	Orrtanna	Adams
McHenry, Clarence	Indiana	Indiana
McIlvaine, J. S.	Fayetteville	Franklin
*McKee, J. M.	Dept. of Agriculture, Harrisburg	Dauphin
McKeehan, James	Honesdale	Wayne
McKibben, E. S.	Fayetteville	Franklin
*MacNeal, William H.	Parkesburg	Chester
McNitt Fruit Farm	Milroy	Mifflin
McPherson Bros.	Bridgeton	York
Marshall, Thomas	Buckmanville	Bucks
Martin, C. S.	Edenville	Franklin
Marvil Package Co.	Laurel, Delaware	
Mack, J. S.	Homer City	Indiana
Martin, Abner	Elizabethtown, R. D.	Lancaster
Matthews, W. H.	Box 313, Salem, Ohio	
Mattern, Jos. C.	310 Newry St., Hollidaysburg	Blair
Mattes, Paul	Emaus R. 1	Lehigh
Maurer, D. Edward	Selinsgrove	Snyder
Mauger, Maurice	Boyertown, R. 2	Berks
Mayer, L. E.	Boyertown	Berks
*Mayer, Guy S.	Willow Street, R. 1	Lancaster
Mechling, Edward A.	Moorestown, N. J.	
Meeder, J. V.	North Girard	Erie
*Meehan, S. Mendelson	Newtown Square	Chester
Meister, Kenneth G.	Chambersburg, R. 6	Franklin
Mellinger, Jacob D.	Lancaster, R. 8	Lancaster
Mellar, Wm.	Wayne	Chester-Delaware
Merring, Guy	Cortez	Wayne
Metzler, Harry R.	Paradise	Lancaster
Miller, Harvey	Loganville	York
Miller, Clement R.	Orefield	Lehigh
Miller, Marvin	Clarks Summit, R. 1	Lackawanna
*Miller, Amos	Hanover, R. 4	York
Miller, Frank M.	42 W. Main St., Waynesboro	Franklin
Miller, C. Clayton	Marion	Franklin
Miller, Crist	Marion	Franklin
Miller, John W.	Ephrata, R. 2	Lancaster
Mennich, C. S.	Reading, R. D. 2	Berks
Mitterling, John T.	Mt. Pleasant Mills	Snyder
Mohring, F. H.	Girard	Erie
Mohr, Frank J.	Fogelsville	Lehigh
Mohrman, Dick	Narrowsburg, N. Y.	Wayne
*Moon, Henry T.	Morrisville	Bucks
Moore, M. A.	Lititz	Lancaster
Moorehead, Douglass	North East	Erie
Morse, Carl	New Wilmington	Lawrence
Mt. Breeze Orchard Co.	Fayetteville, R. 1	Franklin
Mowery, Harold F.	307 W. Main St., Mechanicsburg	Franklin
Mowery, L. O.	Newville	Cumberland
Mowery, N. E.	Mechanicsburg	Cumberland
Moyer, Lee	Freeburg	Snyder
Moyer, J. Calvin	Middleburg, R. 4	Snyder
Moyer, B. J.	Middleburg	Snyder
Murtoff, C. J.	Gardners	Adams
Musselman, C. H. Co.	Biglerville	Adams
Murray, Edward A.	Punxsutawney, R. D.	Indiana

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Name	Address	County
Musser, Irvin W.	Mount Joy	Lancaster
Musser, C. B.	Mt. Wolf, R. 1	York
Musser, W. E.	New Bethlehem, R. 3	Clarion
*Myers, Levi M.	Bowmandale, R. 1	York
Myer, Reuben	Lititz, R. 5	Lancaster
Nash, Duane H.	Haddonfield, N. J.	
Neely, P. A.	Mercersburg, R. 1	Franklin
Neiman, Otto	Dover, R. D. 3	York
Newman, H. W.	New Castle, R. D. 4	Lawrence
Newman, H. M.	Fayetteville	Franklin
Newton, E. M.	New Wilmington, R. 1	Lawrence
Newton, O. A. & Son Co.	Bridgeville, Del.	
Nibert, Wm.	Indiana, R. D.	Indiana
Nichol, Harry	Indiana, R. D.	Indiana
Nicodemus, Ed.	Waynesboro	Franklin
Nitchman, C. H.	Aspers	Adams
Nocilla, Paul	14 Hillside Ave., Plymouth	Luzerne
Nolt, Harrison S.	Columbia	Lancaster
Noss J. A.	New Castle, R. 5	Lawrence
Ober, Dr. H. K.	College Ave., Elizabethtown	Lancaster
*O'Conner, Haldeman	13 N. Front St., Harrisburg	Dauphin
Omwake, J. Edward	Greencastle	Franklin
Oyler, Geo.	McKnightstown	Adams
Oyler, H. J.	Gettysburg, R. D.	Adams
Oyler, William	Arendtsville	Adams
*Page, C. M.	Etters	York
*Pannebaker, William M.	Virgilina, Va.	Halifax
Panovec, Victor	Easton, R. D. 2	Northampton
Parker, Capt. H. B.	261 Newbury St., Boston, Mass.	
Parker, R. C.	333 Morris Ave., Rockville Centre, N. Y.	
Paschal, John	Kennett Square	Chester
Passmore, S. S.	Mendanhall	Chester-Delaware
Passmore, Norman S.	Glen Mills, R. D. 1	Delaware
Patterson, James W.	Apollo	Indiana
Paxson, Samuel L.	Doylestown, R. D.	Bucks
Peiffer, Walter	Chambersburg	Franklin
Pennock, Geo. S.	165 W. Essex Ave., Lansdowne	Chester-Delaware
Pennypacker Company	Emaus	Lehigh
Pepper, J. O.	State College	Centre
Peters, A. D.	Scotland	Franklin
Peters, Curtis	Biglerville	Adams
Peters, Jos. E.	Fayetteville	Franklin
Pherson, J. L.	Volant, R. D.	Lawrence
Poff, Leroy	Hummelstown, R. D.	Dauphin
Pollock, G. B.	Wyoming, R. 3	Luzerne
Poor, D. W.	Narrowsburg, N. Y.	Wayne
Porter, John J.	1199 The Terrace, Hagrsetown, Md.	
*Pratt, B. G.	50 Church Street, New York	
Quigley, Ford F.	Chagrin Falls, Ohio	
Raffensberger, Chas.	Biglerville	Adams
Raffensberger, H. B.	Arendtsville	Adams
*Rankin, Chas. C.	The Kelinworth, Alden Park, Germantown, Philadelphia	
Rapp, Dr. Ira M.	235 N. 6th St., Reading	Berks
Reichard, Chas. W.	Waynesboro	Franklin
Reist, Allen E.	Palmyra, R. 2	Lebanon
Reist, Clarence J.	Landisville	Lancaster
Reist, Henry G.	1166 Avon Rd., Schenectady, N. Y.	
Renfrew, R. N.	Fayetteville	Franklin
Reno, J. H.	Elwood City, R. 1	Lawrence

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Name	Address	County
Reynolds, Milo	Factoryville, R. 2	Lackawanna
Rhine, H. L.	McClure	Snyder
Rice, Daniel	Elliottsburg	Perry
Richards, Frank E.	Clarks Summit, R. 2	Lackawanna
Richardson, W. T. & Son	Whiteford, Md.	York
Rick, Chas. M.	431 Windsor St., Reading	Berks
Rick, John M.	Ellwood City, R. 1	Lawrence
*Rick, John	West Leesport, R. 1	Berks
Riley, J. W. & Sons	New Castle	Lawrence
Riley, Vernon	Fairfield	Adams
*Rinehart, E. S.	Mercersburg	Franklin
Rinn, J. Cloid	Indiana	Indiana
Ritter, Arthur	Allentown, R. 3	Lehigh
Ritter, Astor	Allentown, R. 3	Lehigh
Ritter, Elias	Selinsgrove	Snyder
Rittenhouse, Dr. J. S.	Lorane	Berks
Rittenhouse, S. B.	Lorane	Berks
Roberts, Byron T.	Moorestown, N. J.	
*Roberts, Horace	Moorestown, N. J.	
Robinson, Walter D.	Elliottsburg, Box 14	Perry
Roemhild, Albert C.	122 Dock St., Philadelphia	
*Rhode, William	Johnstown	Cambria
Rohlfing, F. F.	Myerstown, R. 1	Dauphin
Rohrer, Geo. H.	Dryville	Berks
Root, J. W.	Manheim, R. D. 1	Lancaster
Rose, C. S.	Lititz	Lancaster
Rowe, J. C.	Chambersburg, R. 6	Franklin
Rozelle, H. E.	Pittston, R. D.	Luzerne
Rubiscsek, Andrew	594 N. Main St., Wilkes-Barre	Luzerne
Ruhl, Dr. H. F.	Manheim, Box 236	Lancaster
*Runk, J. A.	Huntingdon	Huntingdon
Ruth, Chas.	422 Ridge St., Emaus	Lehigh
Rutt, B. T.	Hummelstown, R. 2	Dauphin
Rutter, Mrs. W. M.	New Holland, R. 2	Lancaster
Sachs, Edward H.	Biglerville	Adams
Sahli, Elmer	Gibsonia	Allegheny
Salsgiver, Andrew	Indiana, R. 7	Indiana
Sampson, A. S.	New Wilmington	Lawrence
Sanville, F.	Westtown, Box 25	Chester
*Satterthwaite, Frederick G.	Yardley	Bucks
Schantz, H. A.	538 Hamilton St., Allentown	Lehigh
Schieferstein, William	Leesport	Berks
Schoelkopf, Carl	Wernersville, R. 3	Berks
Scholl, W. J.	Barto	Berks
Schosley, H. B.	2nd Natl. Bank Bldg., Wilkes-Barre	Luzerne
Schreiber, Harry F.	Zionsville	Lehigh
Schriver, Geo.	Bendersville	Adams
Schantz, L. M.	Orefield, R. D. 1	Lehigh
Schuldt, J. Carlton	Elizabethtown	Lancaster
Schule, E. J.	Hotel Washington, Chambersburg	Franklin
Schultz, Chester K.	Barto	Berks
Seachman, George E.	Windsor, R. D. 1	York
Seaman, George	Honesdale	Wayne
*Searle, Alonza T.	Honesdale	Wayne
Seibert, Earl	Volant	Lawrence
Seitz, John B.	Rohrerstown	Lancaster
*Settemeyer, C. T.	Wilmore, R. D.	Cambria
*Shank, H. L.	Lancaster, R. 7	Lancaster
Shattuck, J. H.	Erie, R. D. 6	Erie

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Name	Address	County
Shatzer, P. R.	1307 Scotland Ave., Chambersburg	Franklin
Shaw, R. C.	Stewartstown	York
Shearer, Walter J.	Vinemont	Berks
Shearer, James W.	Vinemont	Berks
Sheble, Earl	Hamburg, R. 2	Berks
Shenk, D. W.	Lancaster, R. D. 7	Lancaster
Showers, Lloyd	Bethel	Berks
Sidler, Anton	York, R. D. 9	York
*Snively, H. H.	Willow Street	Lancaster
Snyder, Fry & Rick	Reading, R. D. 2	Berks
Snyder, Geo.	Dallas, R. 3	Luzerne
Snyder, T. S.	Brodbecks	York
Snyder, C. B.	Ephrata, R. 1	Lancaster
Snyder, Robert	Pittston, R. 2	Luzerne
Snyder, Simon R.	Ephrata, R. 1	Lancaster
Snyder, Elmer R.	Florin	Indiana
Snyder, Fred	Avonmore, R. D. 1	Lackawanna
Spencer, Glenn	Dalton, R. 3	Snyder
Siegfried, A. H.	Selinsgrove	Indiana
Simpson, J. A.	Indiana, R. D. 5	Franklin
Skinner, H. W.	Chambersburg	Lehigh
Slade, J. E.	2303 Allen St., Allentown	Adams
Slade, Martin	Gettysburg	Adams
Slaybaugh, Glen	Gettysburg, R. 5	Delaware
Smedley, S. L. Jr.	Newtown Square	Delaware
*Smedley, Samuel L. Sr.	Newtown Square	Luzerne
Smith, W. A.	Trucksville, Box 36	
Smith, Leonard R.	Garden St., Mt. Holly, N. J.	Westmoreland
Smith, Philip S.	Laughlintown	Indiana
Smith, A. Woodward	Blairsville, R. D.	Lehigh
Smith, Wm. H.	144 Front St., Catasauqua	Lehigh
Smith, Wm. M.	Orefield, R. D. 1	Luzerne
Smith, Clemon	Nescopeck, R. 1	Luzerne
Smith, B. E.	Pittston, R. 1	Indiana
Smith, Roland M.	Marion Center, R. 2	York
Smith, S. A.	Yoe	Lehigh
Smith, James E.	Bethlehem, R. 4 *	Lackawanna
Smith, Mervin W.	Factoryville, R. 2	
Smith, Lawrence	Box 222, South River, N. J.	Erie
Smith, G. C.	North East	Lebanon
Snively, The Misses	Lebanon, R. D. 5	Lehigh
Smith, G. E.	Bethlehem, R. D. 4	Franklin
Spessard, H. W.	Chambersburg	Snyder
Spigelmyer, J. Martin	McClure, R. 1	Snyder
Spigelmyer, S. W.	McClure	York
Stahle, Carl	Manchester, R. 1	Lititz
Stauffer, T. H.	Lititz, R. D. 1	Lehigh
Stauffer, Wallace	Quakertown, R. D. 3	Westmoreland
*Stear, J. R.	395 Leonard Ave., Washington	York
Stein, Geo. E. & Son	Wrightsville, R. D. 1	Indiana
Stitt, L. P.	Blairsville, R. D. 2	
Stockdale, H. C.	Ravenna, Ohio	Franklin
Stoke, H. W.	2226 Upland St., Chester	Lancaster
Stoneroad, S. A.	New Providence	Indiana
Stonebraker, H. W.	Indiana, R. D. 7	Adams
Stoner, Harry S.	Orrtanna	Berks
Stoudt, Mrs. Lillie K.	Hamburg, R. 1	York
Stover, Jacob E.	York, R. D. 2	Adams
*Strasbaugh, E. F.	Orrtanna	

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Name	Address	County
Straub, W. D.	Middleburg, R. 4	Snyder
Strawser, A. A.	Mt. Pleasant Mills	Snyder
Strickler, D. A.	Coudersport	Adams
Strong, T. M.	Blairsville, R. D. 1	Indiana
Strong, T. C.	1204 W. 27th St., Erie	Erie
Stufflit, Fred	Fogelsville	Lehigh
Stuntz, H. E.	Girard	Erie
Surface, Dr. H. A.	Selinsgrove	Snyder
Sutliff, Dana	Shickshinny, R. D.	Luzerne
*Swank, Luke H.	Swank Hardware Co., Johnstown	Cambria
Swartz, D. H.	Clymer, R. D. 1	Indiana
Swartz, Emma	Spring Grove	York
Syling, E. S.	New Castle, R. 7	Lawrence
Tarbert, D. F.	Dallastown, R. 1	York
Tate, S. C.	Erie, R. D. 6	Erie
Taughinbaugh, G. E.	Gettysburg, R. 10	Adams
*Taylor, Ralph S.	West Chester, R. D.	Chester
*Thomas, Charles L.	King of Prussia	Montgomery
*Thomas, Edwin W.	King of Prussia	Montgomery
Thomford, C. F. B.	Kennett Square	Chester-Delaware
Tobacco By-Products & Chemical Corporation	Louisville, Ky.	
Trefethren, Winthrop N.	Elizabeth Farms, Lititz	Lancaster
Treichler, Raymond	Coplay, R. D. 1	Lehigh
Trexler, T. A.	Northumberland, R. D. 2	Northumberland
Trimble, Edw.	Indiana, R. D.	Indiana
Trostle, Earl	Biglerville	Adams
Turrell, Elmore	Noxen	Wyoming
*Tyler, W. D.	Dante, Va.	
*Tyson, Chester J.	Gardners	Adams
*Tyson, Edwin C.	Flora Dale	Adams
*Tyson, William C.	Flora Dale	Adams
Tyson, Fred	Gardners	Adams
Veety, Wm.	Clarks Summit	Lackawanna
Vogel, E. H.	Lancaster, Box 35	Lancaster
Wagner, Charles E.	McClure	Snyder
Wagner, Harvey	232 Main St., Emaus	Lehigh
Wagonhurst, Mrs. Harry	Bechtelsville, R. D.	Berks
Walker, S. B.	Coplay	Lehigh
Walker, William	New Castle, R. 1	Lawrence
Walter, William	Biglerville	Adams
*Walton, Robert J.	Hummelstown	Dauphin
Way, D. H.	Port Matilda	Centre
Weaver, J. B.	Terre Hill	Lancaster
Weaver, R. A.	Fayetteville, R. 1	Franklin
*Weaver, Abram	Scalp Level	Somerset
Weaver, Wm. S.	Macungie	Lehigh
Weber, Nelson	Orefield	Lehigh
*Weigel, H. M.	Biglerville	Adams
*Weimer, E. A.	Lebanon	Lebanon
Weinberger, J. H.	Zionsville	Lehigh
Wells, Thomas D.	615 Vine St., Scranton	Lackawanna
Welshans, D. D.	Jersey Shore, R. D. 3	Lycoming
Welshans, M. O.	Jersey Shore, R. D. 3	Lycoming
Welty, S. N.	Hallam, R. 1	York
Wenger, C. P.	402 S. State St., Ephrata	Lancaster
Wernig, Chas. M.	York, R. D. 2	York
Wertsch, Edwin	Stevens, R. 2	Lancaster
*Wertz, D. Maurice	Waynesboro	Franklin
Westrick, F. A.	Patton, R. 2	Cambria

* Life Members.

Name	Address	County
*Whisler, Edgar	Etters, R. 1	York
White, Corry	Dallas, R. 3	Luzerne
White, J. W.	Indiana	Indiana
Widders, J. B.	Lancaster, R. D. 3	Lancaster
Wieland, Carl	113 Parkwood St., Williamsport	Lycoming
Wierman, Clayton	Bendersville	Adams
Wiggins, A. W.	Clarks Summit, R. D.	Lackawanna
Williams, D. T.	Romney, W. Va.	
Williams, Luther S.	Indiana, R. D. 1	Indiana
Wilson, David	Bridgeton	York
Wilson, H. W. Co.	950 University Ave., New York	
Wiltshire, Clarence	McKeesport, R. D. 1	Allegheny
Winner, G. B.	American Cyanamid Co., 30 Rockefeller Plaza, N. Y.	
Winter, M. L.	Hellam, R. D. 1	York
Wise, Harvey	Commodore, R. D.	Indiana
*Wister, John C.	Germantown	Philadelphia
*Witherow, R. T.	Punxsutawney	Jefferson
Whitman, John	434 Windsor St., Reading	Berks
Wolf, D. E.	Dallas, R. D. 2	Luzerne
Wolfe, Charles D.	U. B. Quincy Orphanage, Quincy	Franklin
Wolfe, Joseph	Allentown, R. D. 1	Lehigh
Wolfe, Walter	Dallas, R. D. 2	Luzerne
Wolff, F. B.	Lima	Chester-Delaware
Wolfinger, Don L.	Chambersburg, R. 1	Franklin
Wolgemuth, Abner M.	Mt. Joy, R. D. 1	Lancaster
Woodward, N. H.	Mendenhall	Delaware
Worley's Nursery	York Springs, R. D. 1	Adams
Worthington, Harvey C.	West Chester, R. D. 2	Chester
Worthington, H. R.	West Chester	Chester-Delaware
Wotring, Oscar A.	Orefield	Lehigh
Yarshik, Karl	Narrowsburg, N. Y., R. 1	Wayne
Yoat, A. J.	Punxsutawney, R. D. 3	Jefferson
Yoder, Ira L.	Middleburg	Snyder
Yerger, C. R.	Apollo, R. D. 3	Armstrong
Yohe, Jay W.	Fayetteville	Franklin
Young, Miles	Narrowsburg, N. Y.	Wayne
Young, R. C.	Chambersburg	Franklin
*Young, L. G.	North East	Erie
Zarfoss, J. W.	Elizabethtown	Lancaster
Ziegler, E. Calvin	529 W. Market St.	York
Ziegler, J. A. C.	York, R. D. 8	York
Zook, Amos F.	Lancaster, R. D. 5	Lancaster
Zook, I. F.	Curryville	Blair

* Life Members.

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